BILLING CODE 3510-22-P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[RTID 0648-XA918]

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Portsmouth Naval Shipyard Dry Dock 1 Modification and Expansion

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice; proposed incidental harassment authorization; request for comments on proposed authorization and possible renewal.

SUMMARY: NMFS has received a request from the U.S. Navy (Navy) for authorization to take marine mammals incidental to Portsmouth Naval Shipyard Dry Dock 1 modification and expansion in Kittery, Maine. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is requesting comments on its proposal to issue an incidental harassment authorization (IHA) to incidentally take marine mammals during the specified activities. NMFS is also requesting comments on a possible one-time, one-year renewal that could be issued under certain circumstances and if all requirements are met, as described in **Request for Public Comments** at the end of this notice. NMFS will consider public comments prior to making any final decision on the issuance of the requested MMPA authorizations and agency responses will be summarized in the final notice of our decision.

DATES: Comments and information must be received no later than **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].**

ADDRESSES: Comments should be addressed to Jolie Harrison, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service and should be sent by electronic mail to *ITP.esch@noaa.gov*.

Instructions: NMFS is not responsible for comments sent by any other method, to any other address or individual, or received after the end of the comment period. Comments, including all attachments, must not exceed a 25-megabyte file size. All comments received are a part of the public record and will generally be posted online at *https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act* without change. All personal identifying information (*e.g.*, name, address) voluntarily submitted by the commenter may be publicly accessible. Do not submit confidential business information or otherwise sensitive or protected information.

FOR FURTHER INFORMATION CONTACT: Carter Esch, Office of Protected Resources, NMFS, (301) 427-8421. Electronic copies of the application and supporting documents, as well as a list of the references cited in this document, may be obtained online at: *https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act*. In case of problems accessing these documents, please call the contact listed above.

SUPPLEMENTARY INFORMATION:

Background

The MMPA prohibits the "take" of marine mammals, with certain exceptions. Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq*.) direct the Secretary of Commerce (as delegated to NMFS) to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed incidental take authorization may be provided to the public for review.

Authorization for incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s) and will not have an unmitigable adverse impact on the availability of the species or stock(s) for taking for subsistence uses (where relevant). Further, NMFS must prescribe the permissible methods of taking and other means of effecting the least practicable adverse impact on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stocks for taking for certain subsistence uses (referred to in shorthand as "mitigation"); and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth. The definitions of all applicable MMPA statutory terms cited above are included in the relevant sections below.

National Environmental Policy Act

To comply with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq*.) and NOAA Administrative Order (NAO) 216-6A, NMFS must review our proposed action (*i.e.*, the issuance of an IHA) with respect to potential impacts on the human environment.

This action is consistent with categories of activities identified in Categorical Exclusion B4 (IHA with no anticipated serious injury or mortality) of the Companion Manual for NOAA Administrative Order 216-6A, which do not individually or cumulatively have the potential for significant impacts on the quality of the human environment and for which NMFS has not identified any extraordinary circumstances that would preclude this categorical exclusion. Accordingly, NMFS has preliminarily determined that the issuance of the proposed IHA qualifies to be categorically excluded from further NEPA review.

NMFS will review all comments submitted in response to this notice prior to concluding our NEPA process or making a final decision on the IHA request.

Summary of Request

On October 22, 2020, NMFS received a request from the Navy for an IHA to take marine mammals incidental to modification and expansion of Dry Dock 1 at Portsmouth Naval Shipyard in Kittery, Maine. The Navy submitted revised versions of the application on December 30, 2020, and January 19 and February 11, 2021. The application was deemed adequate and complete on February 19, 2021. The Navy's request is for take of harbor porpoises, harbor seals, gray seals, harp seals, and hooded seals by Level B harassment and Level A harassment. Neither the Navy nor NMFS expects serious injury or mortality to result from this activity; therefore, an IHA is appropriate.

NMFS previously issued three IHAs to the Navy for waterfront improvement work, in 2017 (81 FR 85525; November 28, 2016), 2018 (83 FR 3318; January 24, 2018), 2019 (84 FR 24476, May 28, 2019), and a renewal of the 2019 IHA (86 FR 14598;

March 17, 2021). As required, the applicant provided monitoring reports (available at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-construction-activities*) which confirm that the applicant has implemented the required mitigation and monitoring, and which also shows that no impacts of a scale or nature not previously analyzed or authorized have occurred as a result of the activities conducted. This proposed IHA (if issued) would cover the second year of a larger 5-year project, for which the Navy also intends to request take authorization for subsequent dock modification and expansion at the Portsmouth Naval Shipyard.

Description of Proposed Activity

Overview

The purpose of the proposed action is to modernize and maximize dry dock capabilities for performing current and future missions efficiently and with maximum flexibility. The Navy plans to modify and expand Dry Dock 1 (DD1) at the Portsmouth Naval Shipyard (PNSY) by constructing two new dry docking positions capable of servicing Virginia class submarines within the super flood basin of the dry dock.

The in-water portion of the dock modification and expansion work includes:

- Construction of the west closure wall;
- Construction of entrance structure closure walls; and
- Bedrock excavation.

Construction activities that could affect marine mammals are limited to in-water pile driving and removal activities, rock drilling, and underwater blasting.

Dates and Duration

In-water construction activities are expected to begin in spring 2021, with an estimated total of 29 days for pile driving and pile removal, 130 days for drilling of blast charge holes, and 130 days of blasting for bedrock excavation, for a total of 289 construction days. Some of these activities would occur on the same day, resulting in 159 total construction days over 12 months. All in-water construction work will be limited to daylight hours, with the exception of pre-dawn (beginning no earlier than 3:00 AM) drilling of blast charge holes; drilling would not occur from sunset to pre-dawn.

Specific Geographic Region

The Shipyard is located in the Piscataqua River in Kittery, Maine. The Piscataqua River originates at the boundary of Dover, New Hampshire, and Elliot, Maine. The river flows in a southeasterly direction for 21 kilometers (km) before entering Portsmouth Harbor and emptying into the Atlantic Ocean. The lower Piscataqua River is part of the Great Bay Estuary system and varies in width and depth. Many large and small islands break up the straight-line flow of the river as it continues toward the Atlantic Ocean. Seavey Island, the location of the proposed action, is located in the lower Piscataqua River approximately 500 meters (m) from its southwest bank, 200 m from its north bank, and approximately 4 km upstream from the mouth of the river.

A map of the Portsmouth Naval Shipyard dock expansion action area is provided in Figure 1 below; additional maps are available in Figures 1-1 to 1-6 in the IHA application.

Water depths in the proposed project area range from 6.4 to 11.9 m, while water depths in the lower Piscataqua River near the proposed project area range from 4.5 m in the shallowest areas to 21 m in the deepest areas. The river is approximately 1 km wide near the proposed project area, measured from the Kittery shoreline north of Wattlebury Island to the Portsmouth shoreline west of Peirce Island. The furthest direct line of sight from the proposed project area would be 1.3 km to the southeast and 0.4 km to the northwest.

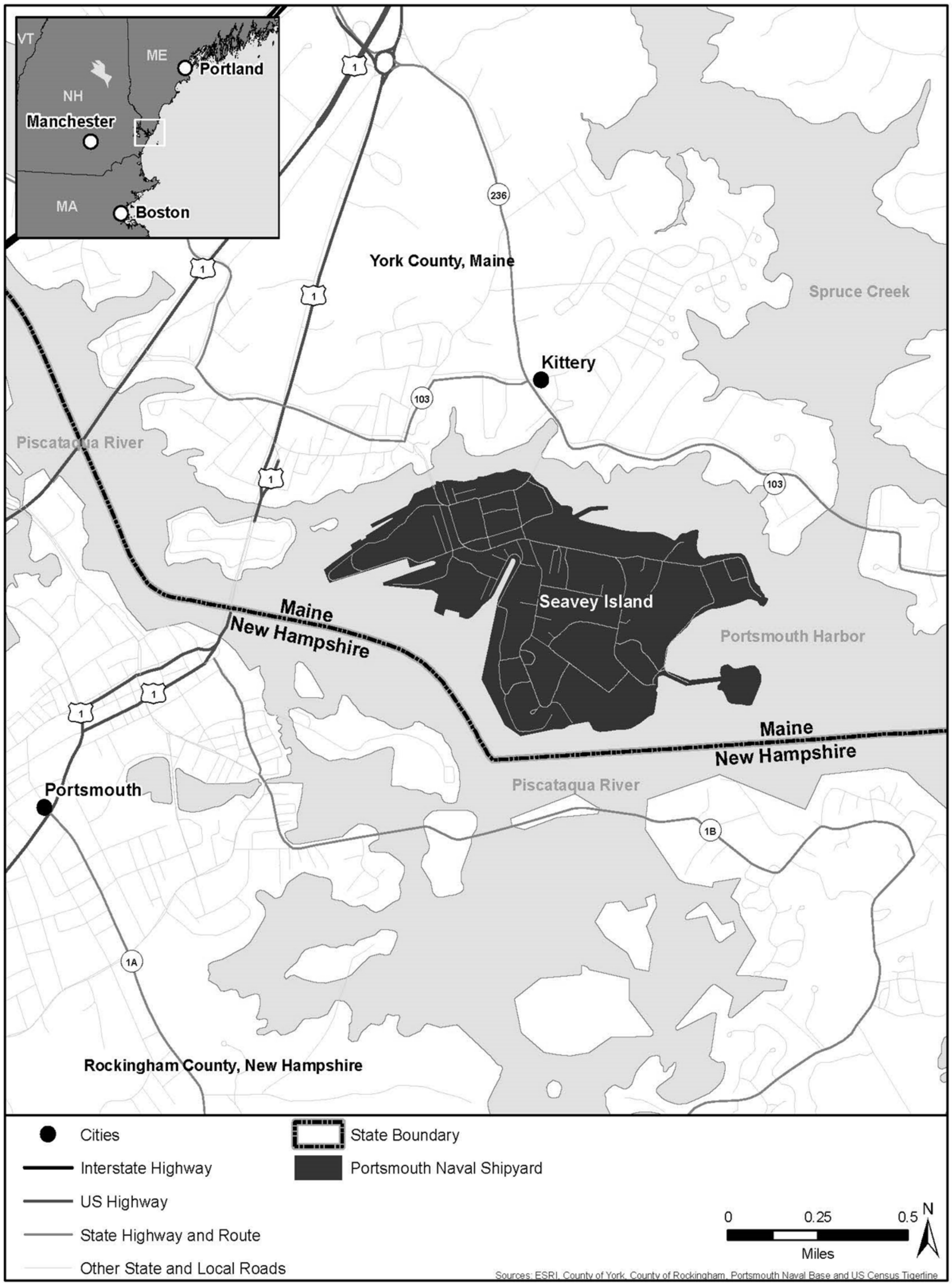

Figure 1. Site Location Map for Portsmouth Naval Ship Yard

Detailed Description of Specific Activity

Under the proposed action, the expansion and modification would occur as multiple construction projects. Prior to the start of construction, the entrance to DD1would be dredged to previously permitted maintenance dredge limits. This dredging effort is required to support the projects; additional project-related dredging would occur intermittently throughout the proposed action. Since dredging and disposal activities would be slow-moving and generate continuous noise similar to other ongoing sources of industrial noise at PNSY, NMFS does not consider its effects as likely to rise to the level of take of marine mammals; therefore, these activities are not discussed further in this document.

The proposed 2021 through 2022 construction activities include pile driving (vibratory and impact), rock drilling, and blasting associated with construction of the super flood basin. The action would take place in and adjacent to DD1 in the Controlled Industrial Area (CIA) that occupies the western extent of the Portsmouth Naval Shipyard.

Construction of the super flood basin phasing would be required to minimize impacts on critical dry dock operations. Six notional construction phases were identified of which the first three were completed under previous IHAs (84 FR 24476, May 28, 2019; 86 FR 10545, February 22, 2021). Phases 4, 5, and 6 would occur under this proposed IHA. This phasing schedule could change due to fleet mission requirements and boat schedules. The first phase of construction occurred when a boat was present and was limited to site reconnaissance, field measurements, contractor submittals and general mobilization activities. Phase 2 included construction of the southern closure wall and caisson seat foundation, Berth 1 and Berth 11 (A and B) improvements, DD1 utility improvements, and dredging. Phase 3 includes construction of the temporary blast wall and completion of the caisson seat foundation, which comprise the entirety of activities to be completed under the renewal IHA. Phases 4 through 6, considered here, would include construction of the west closure wall and entrance structure closure walls, as well as bedrock excavation.

The super flood basin would be created in front of the entrance of DD1 by constructing closure walls that span from Berth 1 to Berth 11. The super flood basin would operate like a navigation lock-type structure: artificially raising the elevation of the water within the basin and dry dock above the tidally controlled river in order to lift the submarines to an elevation where they can be safely transferred into the dry dock without the use of buoyancy assist tanks. Located between Berths 1 and 11, the super flood basin would extend approximately 177 m from the existing outer seat of the dry dock (approximately 53 m beyond the waterside end of Berth 1), and would consist of three primary components: south closure wall, west closure wall, and entrance structure. Construction of the south closure wall was completed under the initial 2019 IHA, with only in-water construction for the west closure wall and the entrance structure scheduled to occur under the IHA proposed here.

The west closure wall would consist of a cellular sheet pile wall with one full cell and a second partial cell. The cells would be filled with crushed stone fill and have a paved access way as a cap. Approximately 160, Z-shaped piles would be installed to construct the west closure wall. The closure wall would be connected to the entrance structure and existing Berth 11 structures, and would be in place for the remainder of the in-water construction activities.

The entrance (*i.e.*, caisson seat) will be constructed under the renewal IHA, including installation of six temporary dolphins, comprised of 12, 30-inch (in) diameter steel pipe piles, to assist with float-in and placement of the caisson seat. Under this proposed IHA, the temporary dolphins would be removed using vibratory extraction once installation of the caisson seat is completed under the renewal IHA (installation will be complete prior to initiation of the construction activities that are the subject of this proposed IHA).

The Navy plans to remove approximately 16,056 cubic meters (m^3) of sediment and 9,939 m^3 of bedrock from the closure wall and Berth 11 face to support increased flexibility within the basin (see Figure 1-5 in the IHA application for more details). The current bedrock elevation at this location would limit submarine and tug movements within the super flood basin. While the super flood basin would be operational without bedrock removal, removing the bedrock would allow the Shipyard additional operational flexibility for using Berth 11 while other aspects of the project are under construction. In addition, the added depth would increase ship clearances resulting in reduced sediment disturbance from boat propellers during docking operations.

Bedrock would be removed by drilling and confined blasting methods, which involves drilling holes in the bedrock, placing the charges in the holes, and then stemming the charges. A barge-mounted rotary action drill would be used to bore into the bedrock to excavate the 4.5-inch diameter holes where the blasting charges would be placed. The drill would operate within a casing that would temporarily contain sediments disturbed during drilling. Air would be injected into the casing to lift sediments during drilling, providing a buffer to sound entering the water column. Charge holes would be approximately 3 to 11 m deep, depending on the depth of the rock that needs to be removed. Stemming is the packing of inert material, such as gravel, sand, or drill cuttings, on top of the charge to the top of the borehole, which confines the pressure and gasses created by the explosive. Confined blasting activities using stemmed charges would occur during an approximately 10 month window when DD1 is expected to be empty. It is anticipated that there would be approximately 130 blasting days, with one or two blast events (*i.e.,* the detonation of multiple charges in sequence with a small delay between the detonations of each individual charge) each day. Production blasting would utilize a maximum of 120 pounds (lbs) of explosives per charge. Depending on the rate of drilling achieved, 5 (minimum) to 30 (maximum) holes would be detonated per blast event. Each charge would be detonated with an approximately 8-millisecond (ms) delay. Therefore, each blast event would only last a total duration of approximately 0.24 seconds (sec) for a 30-hole detonation. A bubble curtain will be deployed across the entrance to the basin during all blast events to reduce acoustics impacts outside of the blasting area. The Navy has not yet determined the exact configuration (single or double bubble curtain) that will be utilized.

Blasting activities include the Navy's requirement to construct a temporary blast wall across the opening of the existing DD1, which will be completed under the renewal IHA prior to the construction activities described here. Following the completion of blasting activities, the blast wall would be removed by underwater torch cutting. Neither NMFS not the Navy anticipate take associated with removal of the blast wall; therefore, this activity is not discussed further.

Overall, the construction work is estimated to take approximately 12 months to complete. The number of construction days (289) does not account for the fact that blast-hole drilling and pile driving would occur concurrently. The proposed schedule, including overlapping activities, is anticipated to reduce the number of actual construction days from 289 days to 159 total days. However, as a conservative measure, construction days are accounted for as consecutive rather than concurrent activities in take estimates (see **Estimated Take** section).

A summary of in-water pile driving activity is provided in Table 1. In addition, a total of 1,580, 4.5-in blast charge holes would be drilled at a rate of 12 holes per day over 130 days. The Navy is proposing one to two blast events per day, with a maximum of six blast events per week; a total of 150 blast events would occur over 130 days.

Table 1. Summary of in-water pile driving activities.

<table>
<tr><th>Pile purpose</th><th>Pile type</th><th>Pile size (inch)</th><th>Pile drive method</th><th>Total piles</th><th>Piles /day</th><th>Work days</th></tr>
<tr><td rowspan="2">West closure wall template</td><td rowspan="2">Steel pipe</td><td rowspan="2">30</td><td rowspan="2">Vibratory</td><td>13 installed</td><td>3</td><td>5</td></tr>
<tr><td>13 removed</td><td>3</td><td>5</td></tr>
<tr><td rowspan="2">West closure wall construction</td><td rowspan="2">Flat-webbed steel sheet</td><td rowspan="2">18</td><td>Vibratory</td><td rowspan="2">160</td><td rowspan="2">12</td><td rowspan="2">13</td></tr>
<tr><td>Impact</td></tr>
<tr><td>Entrance structure temporary guide dolphin removal</td><td>Steel pipe</td><td>30</td><td>Vibratory</td><td>12</td><td>8</td><td>2</td></tr>
<tr><td rowspan="2">Entrance structure closure wall construction</td><td rowspan="2">Steel sheet</td><td rowspan="2">28</td><td>Vibratory</td><td rowspan="2">44</td><td rowspan="2">12</td><td rowspan="2">4</td></tr>
<tr><td>Impact</td></tr>
<tr><td>Total</td><td></td><td></td><td></td><td>242</td><td></td><td>29</td></tr>
</table>

Proposed mitigation, monitoring, and reporting measures are described in detail later in this document (please see **Proposed Mitigation** and **Proposed Monitoring and Reporting**).

Description of Marine Mammals in the Area of Specified Activities

Sections 3 and 4 of the application summarize available information regarding status and trends, distribution and habitat preferences, and behavior and life history, of the potentially affected species. Additional information regarding population trends and threats may be found in NMFS's Stock Assessment Reports (SARs; *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments*) and more general information about these species (*e.g.*, physical and behavioral descriptions) may be found on NMFS's website (*https://www.fisheries.noaa.gov/find-species*).

Table 2 lists all species with expected potential for occurrence in the Piscataqua River in Kittery, Maine, and summarizes information related to the population or stock, including regulatory status under the MMPA and ESA and potential biological removal (PBR), where known. For taxonomy, NMFS follows Committee on Taxonomy (2020). PBR is defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population (as described in NMFS's SARs). While no mortality is anticipated or authorized here, PBR and annual serious injury and mortality from anthropogenic sources are included here as gross indicators of the status of the species and other threats.

Marine mammal abundance estimates presented in this document represent the total number of individuals that make up a given stock or the total number estimated within a particular study or survey area. NMFS's stock abundance estimates for most species represent the total estimate of individuals within the geographic area, if known, that comprises that stock. For some species, this geographic area may extend beyond U.S.

waters. All managed stocks in this region are assessed in NMFS's U.S. Atlantic Marine Mammal SARs. All values presented in Table 2 are the most recent available at the time of publication and are available in the final 2019 SARs (Hayes *et al*., 2020) and draft 2020 SARs, available online at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/draft-marine-mammal-stock-assessment-reports*).

Table 2. Marine mammals with potential presence within the proposed project area.

Common name	Scientific name	Stock	ESA/MMPA status; Strategic (Y/N)[1]	Stock abundance (CV, N_{min}, most recent abundance survey)[2]	PBR	Annual M/SI[3]
Order Cetartiodactyla – Cetacea – Superfamily Odontoceti (toothed whales)						
Family Phocoenidae (porpoises)						
Harbor porpoise	*Phocoena phocoena*	Gulf of Maine/Bay of Fundy	-; N	95,543 (0.31; 74,034; 2016)	851	217
Order Carnivora – Superfamily Pinnipedia						
Family Phocidae (earless seals)						
Harbor seal	*Phoca vitulina*	Western North Atlantic	-; N	75,834 (0.15, 66,884; 2012)	2,006	350
Gray seal	*Halichoerus grypus*	Western North Atlantic	-; N	27,131[4] (0.19; 23,158; 2016)	1,389	4,729
Harp seal	*Pagophilus groenlandicus*	Western North Atlantic	-; N	Unknown (NA, NA)	unk	232,422
Hooded seal	*Cystophora cristata*	Western North Atlantic	-; N	Unknown (NA, NA)	unk	1,680

1 - Endangered Species Act (ESA) status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Under the MMPA, a strategic stock is one for which the level of direct human-caused mortality exceeds PBR or which is determined to be declining and likely to be listed under the ESA within the foreseeable future. Any species or stock listed under the ESA is automatically designated under the MMPA as depleted and as a strategic stock.
2 - NMFS marine mammal stock assessment reports online at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region#reports*. CV is coefficient of variation; N_{min} is the minimum estimate of stock abundance.
3 - These values, found in NMFS's SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (*e.g.*, commercial fisheries, ship strike). Annual M/SI often cannot be determined precisely and is in some cases presented as a minimum value or range. A CV associated with estimated mortality due to commercial fisheries is presented in some cases.
4 - NMFS stock abundance estimate applies to U.S. population only, actual stock abundance is approximately 505,000. The PBR value presented is in relation to the U.S. population, whereas the annual M/SI value is for the entire stock.

All species that could potentially occur in the proposed action area are included in Table 2. More detailed descriptions of marine mammals in the PNSY project area are provided below.

Harbor Porpoise

Harbor porpoises occur from the coastline to deep waters (>1800 meters (m); Westgate *et al.* 1998), although the majority of the population is found over the continental shelf (Hayes *et al*., 2020). In the project area, only the Gulf of Maine/Bay of Fundy stock of harbor porpoise may be present. This stock is found in U.S. and Canadian Atlantic waters and is concentrated in the northern Gulf of Maine and southern Bay of Fundy region, generally in waters less than 150 m deep (Waring *et al.*, 2016).

Marine mammal monitoring was conducted during the Berth 11 Waterfront Improvements project from April 2017 through December 2017 (Cianbro 2018a) and through June 2018 (Cianbro 2018b). Harbor porpoises were observed traveling quickly through the river channel and past the proposed project area. A total of 5 harbor porpoises was sighted between April 2017 and June 2018. One harbor porpoise was sighted during the first year of expansion and modification of DD1.

Harbor Seal

The harbor seal is found in all nearshore waters of the North Atlantic and North Pacific Oceans and adjoining seas above about 30º N (Burns, 2009). In the western North Atlantic, harbor seals are distributed from the eastern Canadian Arctic and Greenland south to southern New England and New York, and occasionally to the Carolinas (Hayes *et al*., 2020). Haulout and pupping sites are located off Manomet, MA and the Isles of Shoals, ME (Waring *et al.,* 2016).

Harbor seals are the most abundant pinniped in the Piscataqua River. They were commonly observed within the proposed project area between the months of April 2017 and June 2018 during the Berth 11 Waterfront Improvements project (Cianbro 2018a, 2018b). The primary behaviors observed during monitoring were milling (diving), swimming, and traveling during nearly 60 percent, 29 percent and 12 percent of observations, respectively (Cianbro 2018a). Marine mammal surveys were conducted for one day of each month in 2017 (NAVFAC Mid-Atlantic 2018); harbor seals were commonly observed near the project area throughout the year, and did not show any seasonality in their presence. A total of 721 (including repeated sightings of individuals) sightings of 658 harbor seals were documented from May through December during the first year of monitoring of construction activities for the expansion and modification of DD1 (Navy 2020). As anticipated, no harbor seal pups were observed during the surveys or monitoring, as known pupping sites are north of the Maine-New Hampshire border (Waring *et al*., 2016).

Gray Seal

There are three major populations of gray seals found in the world; eastern Canada (western North Atlantic stock), northwestern Europe and the Baltic Sea. Gray seals in the project area belong to the western North Atlantic stock. The range for this stock is from New Jersey to Labrador. Current population trends show that gray seal abundance is likely increasing in the U.S. Atlantic Exclusive Economic Zone (EEZ) (Hayes *et al*., 2020). Although the rate of increase is unknown, surveys conducted since their arrival in the 1980s indicate a steady increase in abundance in both Maine and

Massachusetts (Hayes *et al*., 2018). It is believed that recolonization by Canadian gray seals is the source of the U.S. population (Hayes *et al*., 2018).

Twenty-four gray seals were observed within the proposed project area between the months of April and December 2017 (Cianbro 2018a), two during the months of January through June 2018 (Cianbro 2018b), and 12 during a monitoring period from January 2018 through January 2019 (Navy 2019). The primary behavior observed during surveys was milling at just over 60 percent of the time followed by swimming within and traveling through the proposed project area. Only approximately 5 percent of the time were gray seals observed foraging (Cianbro 2018a). Monthly one-day marine mammal surveys also took place during 2017 and 2018, during which six and three sightings of gray seal were recorded, respectively (NAVFAC Mid-Atlantic 2018). Forty-seven (including repeated sighting of individuals) observations of 34 individual gray seals were documented from May through December 2020 during the first year of construction activities for expansion and modification of DD1 (Navy 2020). No gray seal pups were observed during the surveys or monitoring, given known pupping sites for gray seals (like harbor seals) are north of the Maine-New Hampshire border (Waring *et al*., 2016).

Hooded Seal

Hooded seals are also members of the true seal family (*Phocidae*) and are generally found in deeper waters or on drifting pack ice. The world population of hooded seals has been divided into three stocks, which coincide with specific breeding areas, as follows: 1) Northwest Atlantic, 2) Greenland Sea, and 3) White Sea (Waring *et al.,* 2020). The hooded seal is a highly migratory species, and its range can extend from the Canadian arctic to Puerto Rico. In U.S. waters, the species has an increasing presence in the coastal waters between Maine and Florida (Waring *et al.,* 2019). In the U.S., they are considered members of the western North Atlantic stock and generally occur in New England waters from January through May and further south in the summer and fall seasons (Waring *et al.,* 2019).

Population abundance of hooded seals in the western North Atlantic is derived from pup production estimates, which are developed from whelping pack surveys. The most recent population estimate in the western North Atlantic was derived in 2005. There have been no recent surveys conducted or population estimates developed for this species. The 2005 best population estimate for hooded seals is 593,500 individuals, with a minimum population estimate of 543,549 individuals (Waring *et al.,* 2019). Currently, not enough data are available to determine what percentage of this estimate may represent the population within U.S. waters. Hooded seals have been observed in the Piscataqua River; however, they are not as abundant as the more commonly observed harbor seal. Anecdotal sighting information indicates that two hooded seals were observed near the Shipyard in August 2009, but no other observations have been recorded (NAVFAC Mid-Atlantic 2018). Hooded seals were not observed in the proposed project area during marine mammal monitoring or survey events that took place in 2017, 2018, and 2020 (Cianbro 2018a, b; NAVFAC Mid-Atlantic 2018, 2019b, Navy 2019, Stantec 2020).

Harp Seal

The harp seal is a highly migratory species, its range extending throughout the Arctic and North Atlantic Oceans. The world's harp seal population is separated into three stocks, based on associations with specific locations of pagophilic breeding activities: 1) off eastern Canada, 2) on the West Ice off eastern Greenland, and 3) in the White Sea off the coast of Russia. The largest stock, which includes two herds that breed either off the coast of Newfoundland/Labrador or near the Magdelan Islands in the Gulf of St. Lawrence, is equivalent to the western North Atlantic stock. The best estimate of abundance for western North Atlantic harp seals, based on the last survey (in 2012) is 7.4 million, with a minimum estimate of 6.9 million (Waring *et al*., 2020). In U.S. waters, the species has an increasing presence since the 1990s, evidenced by increasing numbers of sightings and strandings in the coastal waters between Maine and New Jersey (Waring *et al*., 2020). Harp seals that occur in the United States are considered members of the western North Atlantic stock and generally occur in New England waters from January through May (Waring *et al*., 2020).

Harp seals have been observed in the Piscataqua River; however, they are not as abundant as the more commonly observed harbor seal. The most recent harp seal sightings in the river were of two single seals on separate days in mid-May 2020 (Stantec 2020). The last harp seal sighting prior to these observations was in 2016 (NAVFAC Mid-Atlantic 2016).

Unusual Mortality Events (UMEs)

Since July 2018, elevated numbers of harbor seal and gray seal mortalities have occurred across Maine, New Hampshire and Massachusetts. This event has been declared a UME. Additionally, stranded seals have shown clinical signs as far south as Virginia, although not in elevated number; therefore, the UME investigation now encompasses all seal strandings from Maine to Virginia. Full or partial necropsy examinations have been conducted on some of the seals and samples have been collected for testing. Based on tests conducted thus far, the main pathogen found in the seals is phocine distemper virus. NMFS is performing additional testing to identify any other factors that may be involved in this UME. Lastly, ice seals (harp and hooded seals) have also started stranding with clinical signs, although not in elevated numbers, and those two seal species have also been added to the UME investigation discussed above. Information on this UME is available online at: *www.fisheries.noaa.gov/new-england-mid-atlantic/marine-life-distress/2018-2020-pinniped-unusual-mortality-event-along*.

Marine Mammal Hearing

Hearing is the most important sensory modality for marine mammals underwater, and exposure to anthropogenic sound can have deleterious effects. To appropriately assess the potential effects of exposure to sound, it is necessary to understand the frequency ranges marine mammals are able to hear. Current data indicate that not all marine mammal species have equal hearing capabilities (*e.g.*, Richardson *et al.*, 1995; Wartzok and Ketten, 1999; Au and Hastings, 2008). To reflect this, Southall *et al.* (2007) recommended that marine mammals be divided into functional hearing groups based on directly measured or estimated hearing ranges on the basis of available behavioral response data, audiograms derived using auditory evoked potential techniques, anatomical modeling, and other data. Note that no direct measurements of hearing ability have been successfully completed for mysticetes (*i.e.*, low-frequency cetaceans). Subsequently, NMFS (2018) described generalized hearing ranges for these marine mammal hearing groups. Generalized hearing ranges were chosen based on the approximately 65 decibel (dB) threshold from the normalized composite audiograms, with the exception for lower limits for low-frequency cetaceans where the lower bound was deemed to be biologically implausible and the lower bound from Southall *et al.* (2007) retained. Marine mammal hearing groups and their associated hearing ranges are provided in Table 3.

Table 3. Marine Mammal Hearing Groups (NMFS, 2018).

Hearing Group	Generalized Hearing Range*
Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 35 kHz
Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 Hz to 160 kHz
High-frequency (HF) cetaceans (true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*)	275 Hz to 160 kHz
Phocid pinnipeds (PW) (underwater) (true seals)	50 Hz to 86 kHz
Otariid pinnipeds (OW) (underwater) (sea lions and fur seals)	60 Hz to 39 kHz
* Represents the generalized hearing range for the entire group as a composite (*i.e.*, all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on ~65 dB threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall *et al*. 2007) and PW pinniped (approximation).	

The pinniped functional hearing group was modified from Southall *et al*. (2007) on the basis of data indicating that phocid species have consistently demonstrated an extended frequency range of hearing compared to otariids, especially in the higher frequency range (Hemilä *et al*., 2006; Kastelein *et al*., 2009; Reichmuth and Holt, 2013).

For more detail concerning these groups and associated frequency ranges, please see NMFS (2018) for a review of available information. Five marine mammal species (one cetacean and four pinniped (all phocid) species) have the reasonable potential to co-occur with the proposed survey activities. Please refer to Table 2. The only cetacean species that may be present, the harbor porpoise, is classified as a high-frequency cetacean.

Potential Effects of Specified Activities on Marine Mammals and their Habitat

This section includes a summary and discussion of the ways that components of the specified activity may impact marine mammals and their habitat. The **Estimated Take** section later in this document includes a quantitative analysis of the number of individuals that are expected to be taken by this activity. The **Negligible Impact Analysis and Determination** section considers the content of this section, the **Estimated Take** section, and the **Proposed Mitigation** section, to draw conclusions regarding the likely impacts of these activities on the reproductive success or survivorship of individuals and how those impacts on individuals are likely to impact marine mammal species or stocks.

Description of Sound

Sound travels in waves, the basic components of which are frequency, wavelength, velocity, and amplitude. Frequency is the number of pressure waves that pass by a reference point per unit of time and is measured in hertz (Hz) or cycles per second. Wavelength is the distance between two peaks of a sound wave; lower frequency sounds have longer wavelengths than higher frequency sounds. Amplitude is the height of the sound pressure wave or the `loudness' of a sound and is typically measured using the dB scale. A dB is the ratio between a measured pressure (with sound) and a reference pressure (sound at a constant pressure, established by scientific standards). It is a logarithmic unit that accounts for large variations in amplitude; therefore, relatively small changes in dB ratings correspond to large changes in sound pressure. When referring to sound pressure levels (SPLs) (the sound force per unit area), sound is referenced in the context of underwater sound pressure to one microPascal (μPa). One pascal is the pressure resulting from a force of one newton exerted over an area of one square meter. The source level (SL) represents the sound level at a distance of 1 m from the source (referenced to 1 μPa). The received level is the sound level at the listener's position. Note that all underwater sound levels in this document are referenced to a pressure of 1 μPa and all airborne sound levels in this document are referenced to a pressure of 20 μPa.

Root mean square (rms) is the quadratic mean sound pressure over the duration of an impulse. Rms is calculated by squaring all of the sound amplitudes, averaging the squares, and then taking the square root of the average (Urick 1983). Rms accounts for both positive and negative values; squaring the pressures makes all values positive so that they may be accounted for in the summation of pressure levels (Hastings and Popper 2005). This measurement is often used in the context of discussing behavioral effects, in part because behavioral effects, which often result from auditory cues, may be better expressed through averaged units than by peak pressures.

When underwater objects vibrate or activity occurs, sound-pressure waves are created. These waves alternately compress and decompress the water as the sound wave travels. Underwater sound waves radiate in all directions away from the source (similar to ripples on the surface of a pond), except in cases where the source is directional. The compressions and decompressions associated with sound waves are detected as changes in pressure by aquatic life and man-made sound receptors such as hydrophones.

Even in the absence of sound from the specified activity, the underwater environment is typically loud due to ambient sound. Ambient sound is defined as environmental background sound levels lacking a single source or point (Richardson *et al*., 1995), and the sound level of a region is defined by the total acoustical energy being generated by known and unknown sources. These sources may include physical (*e.g.*, waves, earthquakes, ice, atmospheric sound), biological (*e.g.*, sounds produced by marine mammals, fish, and invertebrates), and anthropogenic sound (*e.g.*, vessels, dredging, aircraft, construction). A number of sources contribute to ambient sound, including the following (Richardson *et al*., 1995):

- Wind and waves: The complex interactions between wind and water surface, including processes such as breaking waves and wave-induced bubble oscillations and cavitation, are a main source of naturally occurring ambient noise for frequencies between 200 Hz and 50 kilohertz (kHz) (Mitson 1995). In general, ambient sound levels tend to increase with increasing wind speed and wave height. Surf noise becomes important near shore, with measurements collected at a distance of 8.5 km from shore showing an increase of 10 dB in the 100 to 700 Hz band during heavy surf conditions;
- Precipitation: Sound from rain and hail impacting the water surface can become an important component of total noise at frequencies above 500 Hz, and possibly down to 100 Hz during quiet times;
- Biological: Marine mammals can contribute significantly to ambient noise levels, as can some fish and shrimp. The frequency band for biological contributions is from approximately 12 Hz to over 100 kHz; and
- Anthropogenic: Sources of ambient noise related to human activity include transportation (surface vessels and aircraft), dredging and construction, oil and gas drilling and production, seismic surveys, sonar, explosions, and ocean acoustic studies. Shipping noise typically dominates the total ambient noise for frequencies

between 20 and 300 Hz. In general, the frequencies of anthropogenic sounds are below 1 kHz and, if higher frequency sound levels are created, they attenuate rapidly (Richardson *et al*., 1995). Sound from identifiable anthropogenic sources other than the activity of interest (*e.g.*, a passing vessel) is sometimes termed background sound, as opposed to ambient sound.

The sum of the various natural and anthropogenic sound sources at any given location and time—which comprise “ambient” or “background” sound—depends not only on the source levels (as determined by current weather conditions and levels of biological and shipping activity) but also on the ability of sound to propagate through the environment. In turn, sound propagation is dependent on the spatially and temporally varying properties of the water column and sea floor, and is frequency-dependent. As a result of the dependence on a large number of varying factors, ambient sound levels can be expected to vary widely over both coarse and fine spatial and temporal scales. Sound levels at a given frequency and location can vary by 10-20 dB from day to day (Richardson *et al*., 1995). The result is that, depending on the source type and its intensity, sound from the specified activity may be a negligible addition to the local environment or could form a distinctive signal that may affect marine mammals.

Description of Sounds Sources

In-water construction activities associated with the project would include impact and vibratory pile installation and removal, drilling, and blasting. The sounds produced by these activities fall into one of two general sound types: Impulsive and non-impulsive (defined below). The distinction between these two sound types is important because they have differing potential to cause physical effects, particularly with regard to hearing (*e.g.*, Ward 1997 in Southall *et al*., 2007). Please see Southall *et al*. (2007) for an in-depth discussion of these concepts.

Impulsive sound sources (*e.g*., explosions, gunshots, sonic booms, impact pile driving) produce signals that are brief (typically considered to be less than one second), broadband, atonal transients (ANSI 1986; Harris 1998; NIOSH 1998; ISO 2003; ANSI 2005) and occur either as isolated events or repeated in some succession. Impulsive sounds are all characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a rapid decay period that may include a period of diminishing, oscillating maximal and minimal pressures, and generally have an increased capacity to induce physical injury as compared with sounds that lack these features.

Non-impulsive sounds can be tonal, narrowband, or broadband, brief or prolonged, and may be either continuous or non-continuous (ANSI 1995; NIOSH 1998). Some of these non-impulsive sounds can be transient signals of short duration but without the essential properties of impulses (*e.g*., rapid rise time). Examples of non-impulsive sounds include those produced by vessels, aircraft, machinery operations such as drilling or dredging, vibratory pile driving, and active sonar systems. The duration of such sounds, as received at a distance, can be greatly extended in a highly reverberant environment.

Acoustic Impacts

Anthropogenic sounds cover a broad range of frequencies and sound levels and can have a range of highly variable impacts on marine life, from none or minor to potentially severe responses, depending on received levels, duration of exposure, behavioral context, and various other factors. The potential effects of underwater sound from active acoustic sources can potentially result in one or more of the following; temporary or permanent hearing impairment, non-auditory physical or physiological effects, behavioral disturbance, stress, and masking (Richardson *et al*., 1995; Gordon *et al*., 2004; Nowacek *et al*., 2007; Southall *et al*., 2007; Gotz *et al*., 2009). The degree of effect is intrinsically related to the signal characteristics, received level, distance from the source, and duration of the sound exposure. In general, sudden, high level sounds can cause hearing loss, as can longer exposures to lower level sounds. Temporary or permanent loss of hearing will occur almost exclusively for noise within an animal's hearing range. Specific manifestations of acoustic effects are first described before providing discussion specific to the Navy's construction activities.

Richardson *et al*. (1995) described zones of increasing intensity of effect that might be expected to occur, in relation to distance from a source and assuming that the signal is within an animal's hearing range. The first zone is the area within which the acoustic signal would be audible (potentially perceived) to the animal, but not strong enough to elicit any overt behavioral or physiological response. The next zone corresponds with the area where the signal is audible to the animal and of sufficient intensity to elicit behavioral or physiological responsiveness. Third is a zone within which, for signals of high intensity, the received level is sufficient to potentially cause discomfort or tissue damage to auditory or other systems. Overlaying these zones to a certain extent is the area within which masking (*i.e.*, when a sound interferes with or masks the ability of an animal to detect a signal of interest that is above the absolute hearing threshold) may occur; the masking zone may be highly variable in size.

The potential for more severe effects (*i.e*., permanent hearing impairment, certain non-auditory physical or physiological effects) is considered here, although NMFS does not expect that there is a reasonable likelihood that the Navy's activities may result in such effects (see below for further discussion). Marine mammals exposed to high-intensity sound, or to lower-intensity sound for prolonged periods, can experience hearing threshold shift (TS), which is the loss of hearing sensitivity at certain frequency ranges (Kastak *et al*., 1999; Schlundt *et al*., 2000; Finneran *et al*., 2003, 2005). TS can be permanent (PTS), in which case the loss of hearing sensitivity is not fully recoverable, or temporary (TTS), in which case the animal's hearing threshold would recover over time (Southall *et al*., 2007). Repeated sound exposure that leads to TTS could cause PTS. In severe cases of PTS, there can be total or partial deafness, while in most cases the animal has an impaired ability to hear sounds in specific frequency ranges (Kryter 1985).

When PTS occurs, there is physical damage to the sound receptors in the ear (*i.e*., tissue damage), whereas TTS represents primarily tissue fatigue and is reversible (Southall *et al*., 2007). In addition, other investigators have suggested that TTS is within the normal bounds of physiological variability and tolerance and does not represent physical injury (*e.g*., Ward 1997). Therefore, NMFS does not consider TTS to constitute auditory injury.

Relationships between TTS and PTS thresholds have not been studied in marine mammals—PTS data exists only for a single harbor seal (Kastak *et al*., 2008)—but are assumed to be similar to those in humans and other terrestrial mammals. PTS typically occurs at exposure levels at least several dB above that which induces mild TTS: a 40-dB threshold shift approximates PTS onset; *e.g*., Kryter *et al*., 1966; Miller, 1974), whereas a

6-dB threshold shift) approximates TTS onset (*e.g.*, Southall *et al*., 2007). Based on data from terrestrial mammals, a precautionary assumption is that the PTS thresholds for impulsive sounds (such as bombs) are at least 6 dB higher than the TTS threshold on a peak-pressure basis and PTS cumulative sound exposure level thresholds are 15 to 20 dB higher than TTS cumulative sound exposure level thresholds (Southall *et al*., 2007). Given the higher level of sound or longer exposure duration necessary to cause PTS as compared with TTS, it is considerably less likely that PTS could occur.

TTS is the mildest form of hearing impairment that can occur during exposure to sound (Kryter 1985). While experiencing TTS, the hearing threshold rises, and a sound must be at a higher level in order to be heard. In terrestrial and marine mammals, TTS can last from minutes or hours to days (in cases of strong TTS). In many cases, hearing sensitivity recovers rapidly after exposure to the sound ends. Few data on sound levels and durations necessary to elicit mild TTS have been obtained for marine mammals.

Marine mammal hearing plays a critical role in communication with conspecifics, and interpretation of environmental cues for purposes such as predator avoidance and prey capture. Depending on the degree (elevation of threshold in dB), duration (*i.e.*, recovery time), and frequency range of TTS, and the context in which it is experienced, TTS can have effects on marine mammals ranging from discountable to serious. For example, a marine mammal may be able to readily compensate for a brief, relatively small amount of TTS in a non-critical frequency range that occurs during a time where ambient noise is lower and there are not as many competing sounds present. Alternatively, a larger amount and longer duration of TTS sustained during a time when communication is critical for successful mother/calf interactions could have more serious impacts.

Currently, TTS data only exist for four species of cetaceans (bottlenose dolphin (*Tursiops truncatus*), beluga whale (*Delphinapterus leucas*), harbor porpoise, and Yangtze finless porpoise (*Neophocoena asiaeorientalis*) and three species of pinnipeds (northern elephant seal (*Mirounga angustirostris*), harbor seal, and California sea lion (*Zalophus californianus*)) exposed to a limited number of sound sources (*i.e*., mostly tones and octave-band noise) in laboratory settings (*e.g*., Finneran *et al*., 2002; Nachtigall *et al*., 2004; Kastak *et al*., 2005; Lucke *et al*., 2009). In general, harbor seals (Kastak *et al*., 2005; Kastelein *et al*., 2012a) and harbor porpoises (Lucke *et al*., 2009; Kastelein *et al*., 2012b) have a lower TTS onset than other measured pinniped or cetacean species. Additionally, the existing marine mammal TTS data come from a limited number of individuals within these species. There are no data available on noise-induced hearing loss for mysticetes. For summaries of data on TTS in marine mammals or for further discussion of TTS onset thresholds, please see Southall *et al*. (2007) and Finneran and Jenkins (2012).

In addition to PTS and TTS, there is a potential for non-auditory physiological effects or injuries that theoretically might occur in marine mammals exposed to high level underwater sound or as a secondary effect of extreme behavioral reactions (*e.g*., change in dive profile as a result of an avoidance reaction) caused by exposure to sound. These impacts can include neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage (Cox *et al*., 2006; Southall *et al*., 2007; Zimmer and Tyack 2007). The Navy's activities involve the use of explosives, which has been associated with these types of effects. The underwater explosion will send a shock wave and blast noise through the water, release gaseous by-products, create an oscillating bubble, and cause a plume of water to shoot up from the water surface. The shock wave and blast noise are of most concern to marine animals. The effects of an underwater explosion on a marine mammal depends on many factors, including the size, type, and depth of both the animal and the explosive charge; the depth of the water column; and the standoff distance between the charge and the animal, as well as the sound propagation properties of the environment. Potential impacts can range from brief effects (such as behavioral disturbance), tactile perception, physical discomfort, slight injury of the internal organs and the auditory system, to death of the animal (Yelverton *et al*., 1973; DoN, 2001). Non-lethal injury includes slight injury to internal organs and the auditory system; however, delayed lethality can be a result of individual or cumulative sublethal injuries (DoN, 2001). Immediate lethal injury would be a result of massive combined trauma to internal organs as a direct result of proximity to the point of detonation (DoN 2001). Generally, the higher the level of impulse and pressure level exposure, the more severe the impact to an individual.

Injuries resulting from a shock wave take place at boundaries between tissues of different density. Different velocities are imparted to tissues of different densities, and this can lead to their physical disruption. Blast effects are greatest at the gas-liquid interface (Landsberg 2000). Gas-containing organs, particularly the lungs and gastrointestinal (GI) tract, are especially susceptible (Goertner 1982; Hill 1978; Yelverton *et al*., 1973). In addition, gas-containing organs including the nasal sacs, larynx, pharynx, trachea, and lungs may be damaged by compression/expansion caused by the oscillations of the blast gas bubble. Intestinal walls can bruise or rupture, with subsequent hemorrhage and escape of gut contents into the body cavity. Less severe GI tract injuries include contusions, petechiae (small red or purple spots caused by bleeding in the skin), and slight hemorrhaging (Yelverton *et al*., 1973).

Because the ears are the most sensitive to pressure, they are the organs most sensitive to injury (Ketten 2000). Sound-related damage associated with blast noise can be theoretically distinct from injury from the shock wave, particularly farther from the explosion. If an animal is able to hear a noise, at some level it can damage its hearing by causing decreased sensitivity (Ketten 1995). Sound-related trauma can be lethal or sub-lethal. Lethal impacts are those that result in immediate death or serious debilitation in or near an intense source and are not, technically, pure acoustic trauma (Ketten 1995). Sub-lethal impacts include hearing loss, which is caused by exposures to perceptible sounds. Severe damage (from the shock wave) to the ears includes tympanic membrane rupture, fracture of the ossicles, damage to the cochlea, hemorrhage, and cerebrospinal fluid leakage into the middle ear. Moderate injury implies partial hearing loss due to tympanic membrane rupture and blood in the middle ear. Permanent hearing loss also can occur when the hair cells are damaged by one very loud event, as well as by prolonged exposure to a loud noise or chronic exposure to noise. The level of impact from blasts depends on both an animal's location and, at outer zones, on its sensitivity to the residual noise (Ketten 1995).

The above discussion concerning underwater explosions only pertains to open water detonations in a free field without mitigation. Therefore, given the proposed monitoring and mitigation measures discussed below, the Navy’s blasting events are not likely to have injury or mortality effects on marine mammals in the project vicinity. Instead, NMFS considers that the Navy's blasts are most likely to cause behavioral harassment and may cause TTS or, in some cases PTS, in a few individual marine mammals, as discussed below.

Behavioral Effects

Behavioral disturbance may include a variety of effects, including subtle changes in behavior (*e.g.*, minor or brief avoidance of an area or changes in vocalizations), more conspicuous changes in similar behavioral activities, and more sustained and/or potentially severe reactions, such as displacement from or abandonment of high-quality habitat. Behavioral responses to sound are highly variable and context-specific and any reactions depend on numerous intrinsic and extrinsic factors (*e.g.*, species, state of maturity, experience, current activity, reproductive state, auditory sensitivity, time of day), as well as the interplay between factors (*e.g.*, Richardson *et al*., 1995; Wartzok *et al*., 2003; Southall *et al*., 2007; Weilgart, 2007; Archer *et al*., 2010). Behavioral reactions can vary not only among individuals but also within an individual, depending on previous experience with a sound source, context, and numerous other factors (Ellison *et al*., 2012), and can vary depending on characteristics associated with the sound source (*e.g.*, whether it is moving or stationary, number of sources, distance from the source). Please see Appendices B-C of Southall *et al*. (2007) for a review of studies involving marine mammal behavioral responses to sound.

Habituation can occur when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok *et al*., 2003). Animals are most likely to habituate to sounds that are predictable and unvarying.

It is important to note that habituation is appropriately considered as a "progressive reduction in response to stimuli that are perceived as neither aversive nor beneficial," rather than as, more generally, moderation in response to human disturbance (Bejder *et al.*, 2009). The opposite process is sensitization, when an unpleasant experience leads to subsequent responses, often in the form of avoidance, at a lower level of exposure. As noted, behavioral state may affect the type of response. For example, animals that are resting may show greater behavioral change in response to disturbing sound levels than animals that are highly motivated to remain in an area for feeding (Richardson *et al.*, 1995; NRC 2003; Wartzok *et al.*, 2003). Controlled experiments with captive marine mammals have showed pronounced behavioral reactions, including avoidance of loud sound sources (Ridgway *et al.*, 1997; Finneran *et al.*, 2003). Observed responses of wild marine mammals to loud-impulsive sound sources (typically seismic airguns or acoustic harassment devices) have been varied but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Morton and Symonds 2002; see also Richardson *et al.*, 1995; Nowacek *et al.*, 2007).

Available studies show wide variation in response to underwater sound; therefore, it is difficult to predict specifically how any given sound in a particular instance might affect marine mammals perceiving the signal. If a marine mammal does react briefly to an underwater sound by changing its behavior or moving a small distance, the impacts of the change are unlikely to be significant to the individual, let alone the stock or population. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on individuals and populations could be significant (*e.g.*, Lusseau and Bejder 2007; Weilgart 2007; NRC 2005). This highlights the importance of assessing the context of the acoustic effects alongside the received levels anticipated. Severity of effects from a response to an acoustic stimuli can likely vary based on the context in which the stimuli was received, particularly if it occurred during a biologically sensitive temporal or spatial point in the life history of the animal. There are broad categories of potential response, described in greater detail here, that include alteration of dive behavior, alteration of foraging behavior, effects to breathing, interference with or alteration of vocalization, avoidance, and flight.

Changes in dive behavior can vary widely, and may consist of increased or decreased dive times and surface intervals as well as changes in the rates of ascent and descent during a dive (*e.g*., Frankel and Clark 2000; Costa *et al*., 2003; Ng and Leung 2003; Nowacek *et al*., 2004; Goldbogen *et al*., 2013a,b). Variations in dive behavior may reflect interruptions in biologically significant activities (*e.g*., foraging) or they may be of little biological significance. The impact of an alteration to dive behavior resulting from an acoustic exposure depends on what the animal is doing at the time of the exposure and the type and magnitude of the response.

Disruption of feeding behavior can be difficult to correlate with anthropogenic sound exposure, so it is usually inferred by observed displacement from known foraging areas, the appearance of secondary indicators (*e.g*., bubble nets or sediment plumes), or changes in dive behavior. As for other types of behavioral response, the frequency, duration, and temporal pattern of signal presentation, as well as differences in species sensitivity, are likely contributing factors to differences in response in any given circumstance (*e.g*., Croll *et al*., 2001; Nowacek *et al*., 2004; Madsen *et al*., 2006; Yazvenko *et al*., 2007). A determination of whether foraging disruptions incur fitness consequences would require information on or estimates of the energetic requirements of the affected individuals and the relationship between prey availability, foraging effort and success, and the life history stage of the animal.

Variations in respiration naturally vary with different behaviors and alterations to breathing rate as a function of acoustic exposure can be expected to co-occur with other behavioral reactions, such as a flight response or an alteration in diving. However, respiration rates in and of themselves may be representative of annoyance or an acute stress response. Various studies have shown that respiration rates may either be unaffected or could increase, depending on the species and signal characteristics, again highlighting the importance in understanding species differences in the tolerance of underwater noise when determining the potential for impacts resulting from anthropogenic sound exposure (*e.g*., Kastelein *et al*., 2001, 2005b, 2006; Gailey *et al*., 2007).

Marine mammals vocalize for different purposes and across multiple modes, such as whistling, echolocation click production, calling, and singing. Changes in vocalization behavior in response to anthropogenic noise can occur for any of these modes and may result from a need to compete with an increase in background noise or may reflect increased vigilance or a startle response. For example, in the presence of potentially masking signals, humpback whales and killer whales have been observed to increase the length of their songs (Miller *et al*., 2000; Fristrup *et al*., 2003; Foote *et al*., 2004), while right whales (*Eubalaena glacialis*) have been observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic noise (Parks *et al*., 2007b). In some cases, animals may cease sound production during production of aversive signals (Bowles *et al*., 1994).

Avoidance is the displacement of an individual from an area or migration path because of the presence of a sound or other stressors, and is one of the most obvious manifestations of disturbance in marine mammals (Richardson *et al*., 1995). For example, gray whales (Eschrictius robustus) are known to change direction—deflecting from customary migratory paths—in order to avoid noise from seismic surveys (Malme *et al*., 1984). Avoidance may be short-term, with animals returning to the area once the noise has ceased (*e.g*., Bowles *et al*., 1994; Goold, 1996; Stone *et al*., 2000; Morton and Symonds, 2002; Gailey *et al*., 2007). Longer-term displacement is possible, however, which may lead to changes in abundance or distribution patterns of the affected species in the affected region if habituation to the presence of the sound does not occur (*e.g*., Blackwell *et al*., 2004; Bejder *et al*., 2006; Teilmann *et al*., 2006).

A flight response is a dramatic change in normal movement to a directed and rapid movement away from the perceived location of a sound source. The flight response differs from other avoidance responses in the intensity of the response (*e.g*., directed movement, rate of travel). Relatively little information on flight responses of marine mammals to anthropogenic signals exist, although observations of flight responses to the presence of predators have occurred (Connor and Heithaus 1996). The result of a flight response could range from brief, temporary exertion and displacement from the area where the signal provokes flight to, in extreme cases, marine mammal strandings (Evans and England 2001). However, it should be noted that response to a perceived predator does not necessarily invoke flight (Ford and Reeves 2008), and whether individuals are solitary or in groups may influence the response.

Behavioral disturbance can also impact marine mammals in more subtle ways. Increased vigilance may result in costs related to diversion of focus and attention (*i.e.*, when a response consists of increased vigilance, it may come at the cost of decreased attention to other critical behaviors such as foraging or resting). These effects have generally not been demonstrated for marine mammals, but studies involving fish and terrestrial animals have shown that increased vigilance may substantially reduce feeding rates (*e.g.*, Beauchamp and Livoreil 1997; Fritz *et al*., 2002; Purser and Radford 2011). In addition, chronic disturbance can cause population declines through reduction of fitness (*e.g.*, decline in body condition) and subsequent reduction in reproductive success, survival, or both (*e.g.*, Harrington and Veitch, 1992; Daan *et al*., 1996; Bradshaw *et al*., 1998). However, Ridgway *et al*. (2006) reported that increased vigilance in bottlenose dolphins exposed to sound over a 5 day period did not cause any sleep deprivation or stress effects.

Many animals perform vital functions, such as feeding, resting, traveling, and socializing, on a diel cycle (24-hour cycle). Disruption of such functions resulting from reactions to stressors such as sound exposure are more likely to be significant if they last more than one diel cycle or recur on subsequent days (Southall *et al*., 2007). Consequently, a behavioral response lasting less than one day and not recurring on subsequent days is not considered particularly severe unless it could directly affect reproduction or survival (Southall *et al*., 2007). Note that there is a difference between multi-day substantive behavioral reactions and multi-day anthropogenic activities. For example, just because an activity lasts for multiple days does not necessarily mean that individual animals are either exposed to activity-related stressors for multiple days or, further, exposed in a manner resulting in sustained multi-day substantive behavioral responses.

Stress Response

An animal's perception of a threat may be sufficient to trigger stress responses consisting of some combination of behavioral responses, autonomic nervous system responses, neuroendocrine responses, or immune responses (*e.g*., Seyle 1950; Moberg 2000). In many cases, an animal's first and sometimes most economical (in terms of energetic costs) response is behavioral avoidance of the potential stressor. Autonomic nervous system responses to stress typically involve changes in heart rate, blood pressure, and gastrointestinal activity. These responses have a relatively short duration and may or may not have a significant long-term effect on an animal's fitness.

Neuroendocrine stress responses often involve the hypothalamus-pituitary-adrenal system. Virtually all neuroendocrine functions that are affected by stress—including immune competence, reproduction, metabolism, and behavior—are regulated by pituitary hormones. Stress-induced changes in the secretion of pituitary hormones have been implicated in failed reproduction, altered metabolism, reduced immune competence, and behavioral disturbance (*e.g*., Moberg 1987; Blecha 2000). Increases in the circulation of glucocorticoids are also equated with stress (Romano *et al*., 2004).

The primary distinction between stress (which is adaptive and does not normally place an animal at risk) and "distress" is the cost of the response. During a stress response, an animal uses glycogen stores that can be quickly replenished once the stress is alleviated. In such circumstances, the cost of the stress response would not pose serious fitness consequences. However, when an animal does not have sufficient energy reserves to satisfy the energetic costs of a stress response, energy resources must be diverted from other functions. This state of distress will last until the animal replenishes its energetic reserves sufficient to restore normal function.

Relationships between these physiological mechanisms, animal behavior, and the costs of stress responses are well studied through controlled experiments and for both laboratory and free-ranging animals (*e.g*., Holberton *et al*., 1996; Hood *et al*., 1998; Jessop *et al*., 2003; Krausman *et al*., 2004; Lankford *et al*., 2005). Stress responses due to exposure to anthropogenic sounds or other stressors and their effects on marine mammals have also been reviewed (Fair and Becker 2000; Romano *et al*., 2002b) and, more rarely, studied in wild populations (*e.g*., Romano *et al*., 2002a). For example, Rolland *et al*. (2012) found that noise reduction from reduced ship traffic in the Bay of Fundy was associated with decreased stress in North Atlantic right whales. These and other studies lead to a reasonable expectation that some marine mammals will experience physiological stress responses upon exposure to acoustic stressors and that it is possible that some of these would be classified as "distress." In addition, any animal experiencing TTS would likely also experience stress responses (NRC, 2003).

Acoustic Effects, Underwater

The effects of sounds from the Navy's proposed activities might include one or more of the following: temporary or permanent hearing impairment, non-auditory physical or physiological effects, behavioral disturbance, and masking (Richardson *et al*., 1995; Gordon *et al*., 2003; Nowacek *et al*., 2007; Southall *et al*., 2007). The effects of pile driving, drilling, and blasting on marine mammals are dependent on several factors, including the type and depth of the animal; the pile size and type, and the intensity and duration of the pile driving, drilling, or blasting sound; the substrate; the standoff distance between the pile and the animal; and the sound propagation properties of the environment. Impacts to marine mammals from pile driving, drilling, and blasting activities are expected to result primarily from acoustic propagation pathways. As such, the degree of effect is intrinsically related to the frequency, received level, and duration of the sound exposure, which are in turn influenced by the distance between the animal and the source. The further away from the source, the less intense the exposure should be. The substrate and depth of the habitat affect the sound propagation properties of the environment. In addition, substrates that are soft (*e.g*., mud) would absorb or attenuate the sound more readily than hard substrates (*e.g*., rock), which may reflect the acoustic wave. Soft porous substrates would also likely require less time to install or extract a pile, and possibly less forceful equipment, which would ultimately decrease the intensity of the acoustic source.

In the absence of mitigation, impacts to marine species could be expected to include physiological and behavioral responses to the acoustic signature (Viada *et al*., 2008). Potential impacts from impulsive sound sources like blasting can range in severity from effects such as behavioral disturbance to temporary or permanent hearing impairment (Yelverton *et al*., 1973). Due to the characteristics of the sounds involved in the project, behavioral disturbance is the most likely effect from the proposed activity. Marine mammals exposed to high intensity sound repeatedly or for prolonged periods can experience hearing threshold shifts. PTS constitutes injury, but TTS does not (Southall *et* *al*., 2007). Due to the use mitigation measures discussed in detail in the **Proposed Mitigation** section, it is unlikely but possible that PTS or TTS could occur from blasting. Neither NMFS nor the Navy anticipates non-auditory injuries of marine mammals as a result of the proposed construction activities.

Disturbance Reactions

With pile removal as well as drilling activities, it is likely that the onset of sound sources could result in temporary, short-term changes in an animal's typical behavior and/or avoidance of the affected area. These behavioral changes may include (Richardson *et al*., 1995): changing durations of surfacing and dives, number of blows per surfacing, or moving direction and/or speed; reduced/increased vocal activities; changing/cessation of certain behavioral activities (such as socializing or feeding); visible startle response or aggressive behavior (such as tail/fluke slapping or jaw clapping); avoidance of areas where sound sources are located; and/or flight responses (*e.g*., pinnipeds flushing into water from haulouts or rookeries). Pinnipeds may increase their haul-out time, possibly to avoid in-water disturbance (Thorson and Reyff 2006). If a marine mammal responds to a stimulus by changing its behavior (*e.g*., through relatively minor changes in locomotion direction/speed or vocalization behavior), the response may or may not constitute taking at the individual level, and is unlikely to affect the stock or the species as a whole. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on animals, and if so potentially on the stock or species, could potentially be significant (*e.g*., Lusseau and Bejder 2007; Weilgart 2007).

The biological significance of many of these behavioral disturbances is difficult to predict, especially if the detected disturbances appear minor. However, the consequences of behavioral modification could be biologically significant if the change affects growth, survival, or reproduction. Significant behavioral modifications that could potentially lead to effects on growth, survival, or reproduction include:

- Drastic changes in diving/surfacing patterns (such as those thought to cause beaked whale stranding due to exposure to military mid-frequency tactical sonar);
- Longer-term habitat abandonment due to loss of desirable acoustic environment; and
- Longer-term cessation of feeding or social interaction.

The onset of behavioral disturbance from anthropogenic sound depends on both external factors (characteristics of sound sources and their paths) and the specific characteristics of the receiving animals (hearing, motivation, experience, demography) and is difficult to predict (Southall *et al*., 2007).

Auditory Masking

Sound can disrupt behavior through masking, or interfering with, an animal's ability to detect, recognize, or discriminate between acoustic signals of interest (*e.g*., those used for intraspecific communication and social interactions, prey detection, predator avoidance, navigation) (Richardson *et al*., 1995). Masking occurs when the receipt of a sound is interfered with by another coincident sound at similar frequencies and at similar or higher intensity, and may occur whether the sound is natural (*e.g*., snapping shrimp, wind, waves, precipitation) or anthropogenic (*e.g*., shipping, sonar, seismic exploration) in origin. The ability of a noise source to mask biologically important sounds depends on the characteristics of both the noise source and the signal of interest (*e.g.*, signal-to-noise ratio, temporal variability, direction), in relation to each other and to an animal's hearing abilities (*e.g.*, sensitivity, frequency range, critical ratios, frequency discrimination, directional discrimination, age or TTS hearing loss), and existing ambient noise and propagation conditions.

Under certain circumstances, marine mammals experiencing significant masking could also be impaired from maximizing their performance fitness in survival and reproduction. Therefore, when the coincident (masking) sound is man-made, it may be considered harassment when disrupting or altering critical behaviors. It is important to distinguish TTS and PTS, which persist after the sound exposure, from masking, which occurs during the sound exposure. Because masking (without resulting in TS) is not associated with abnormal physiological function, it is not considered a physiological effect, but rather a potential behavioral effect.

The frequency range of the potentially masking sound is important in determining any potential behavioral impacts. For example, low-frequency signals may have less effect on high-frequency echolocation sounds produced by odontocetes but are more likely to affect detection of mysticete communication calls and other potentially important natural sounds such as those produced by surf and some prey species. The masking of communication signals by anthropogenic noise may be considered as a reduction in the communication space of animals (*e.g.*, Clark *et al*., 2009) and may result in energetic or other costs as animals change their vocalization behavior (*e.g.*, Miller *et al*., 2000; Foote *et al*., 2004; Parks *et al*., 2007b; Di Iorio and Clark 2009; Holt *et al*., 2009). Masking can be reduced in situations where the signal and noise come from different directions (Richardson *et al*., 1995), through amplitude modulation of the signal, or through other compensatory behaviors (Houser and Moore 2014). Masking can be tested directly in captive species (*e.g*., Erbe 2008), but in wild populations it must be either modeled or inferred from evidence of masking compensation. There are few studies addressing real-world masking sounds likely to be experienced by marine mammals in the wild (*e.g*., Branstetter *et al*., 2013).

Masking affects both senders and receivers of acoustic signals and can potentially have long-term chronic effects on marine mammals at the population level as well as at the individual level. Low-frequency ambient sound levels have increased by as much as 20 dB (more than three times in terms of SPL) in the world's ocean from pre-industrial periods, with most of the increase from distant commercial shipping (Hildebrand 2009). All anthropogenic sound sources, but especially chronic and lower-frequency signals (*e.g*., from vessel traffic), contribute to elevated ambient sound levels, thus intensifying masking.

Potential Effects on Marine Mammal Habitat

Water quality – Temporary and localized reduction in water quality will occur as a result of in-water construction activities. Most of this effect will occur during the installation of piles and blasting when bottom sediments are disturbed. Effects to turbidity and sedimentation are expected to be short-term, minor, and localized. Currents are strong in the area and, therefore, suspended sediments in the water column should dissipate and quickly return to background levels. Following the completion of sediment-disturbing activities, the turbidity levels are expected to return to normal ambient levels following the end of construction. Turbidity within the water column has the potential to reduce the level of oxygen in the water and irritate the gills of prey fish species in the proposed project area. However, turbidity plumes associated with the project would be temporary and localized, and fish in the proposed project area would be able to move away from and avoid the areas where plumes may occur. It is expected that the impacts on prey fish species from turbidity and, therefore, on marine mammals, would be minimal and temporary. In general, the area likely impacted by the project is relatively small compared to the available habitat in Great Bay Estuary, and there is no biologically important area for marine mammals that could be affected. As a result, activity at the project site would be inconsequential in terms of its effects on marine mammal foraging.

Effects to Prey – Sound may affect marine mammals through impacts on the abundance, behavior, or distribution of prey species (*e.g.*, crustaceans, cephalopods, fish, zooplankton). Marine mammal prey varies by species, season, and location and, for some, is not well documented. Studies regarding the effects of noise on known marine mammal prey are described here.

Fish utilize the soundscape and components of sound in their environment to perform important functions such as foraging, predator avoidance, mating, and spawning (*e.g.*, Zelick *et al*., 1999; Fay, 2009). Depending on their hearing anatomy and peripheral sensory structures, which vary among species, fishes hear sounds using pressure and particle motion sensitivity capabilities and detect the motion of surrounding water (Fay *et al*., 2008). The potential effects of noise on fishes depends on the overlapping frequency range, distance from the sound source, water depth of exposure, and species-specific hearing sensitivity, anatomy, and physiology. Key impacts to fishes may include behavioral responses, hearing damage, barotrauma (pressure-related injuries), and mortality.

Fish react to sounds which are especially strong and/or intermittent low-frequency sounds, and behavioral responses such as flight or avoidance are the most likely effects. Short duration, sharp sounds can cause overt or subtle changes in fish behavior and local distribution. The reaction of fish to noise depends on the physiological state of the fish, past exposures, motivation (*e.g.*, feeding, spawning, migration), and other environmental factors. Hastings and Popper (2005) identified several studies that suggest fish may relocate to avoid certain areas of sound energy. Additional studies have documented effects of pile driving on fish, although several are based on studies in support of large, multiyear bridge construction projects (*e.g.*, Scholik and Yan, 2001, 2002; Popper and Hastings, 2009). Several studies have demonstrated that impulse sounds might affect the distribution and behavior of some fishes, potentially impacting foraging opportunities or increasing energetic costs (*e.g.*, Fewtrell and McCauley, 2012; Pearson *et al*., 1992; Skalski *et al*., 1992; Santulli *et al*., 1999; Paxton *et al*., 2017). However, some studies have shown no or slight reaction to impulse sounds (*e.g.*, Pena *et al*., 2013; Wardle *et al*., 2001; Jorgenson and Gyselman, 2009; Cott *et al*., 2012). More commonly, though, the impacts of noise on fish are temporary.

SPLs of sufficient strength have been known to cause injury to fish and fish mortality. However, in most fish species, hair cells in the ear continuously regenerate and loss of auditory function likely is restored when damaged cells are replaced with new cells. Halvorsen *et al*. (2012a) showed that a TTS of 4-6 dB was recoverable within 24 hours for one species. Impacts would be most severe when the individual fish is close to the source and when the duration of exposure is long. Injury caused by barotrauma can range from slight to severe and can cause death, and is most likely for fish with swim bladders. Barotrauma injuries have been documented during controlled exposure to impact pile driving (Halvorsen *et al*., 2012b; Casper *et al*., 2013).

Construction activities would produce continuous (*i.e*., vibratory pile driving and removal, and drilling) and impulsive (*i.e.,* impact pile driving and blasting) sounds. The duration of impact pile driving for the proposed project would be limited to the final stage of installation ("proofing") after the pile has been driven as close as practicable to the design depth with a vibratory driver. Vibratory pile driving and drilling would possibly elicit behavioral reactions from fish, such as temporary avoidance of the area, but are unlikely to cause injuries to fish or have persistent effects on local fish populations. The duration of fish avoidance of this area after pile driving and drilling stop is unknown, but a return to normal recruitment, distribution and behavior is anticipated. While impacts from blasting to fish are more severe, including barotrauma and mortality, the blast will last less than one second for each blast event, making the duration of this acoustic impact short term. In addition, it should be noted that the area in question is low-quality habitat since it is already highly developed and experiences a high level of anthropogenic noise from normal Shipyard operations and other vessel traffic. In general, impacts on marine mammal prey species are expected to be minor and temporary.

Construction may have temporary impacts on benthic invertebrate species, another marine mammal prey source. Direct benthic habitat loss would result with the permanent loss of approximately 3.5 acres of benthic habitat from construction of the super flood basin. However, the areas to be permanently removed are beneath and adjacent to the existing berths along the Shipyard's industrial waterfront and are regularly disturbed as part of the construction dredging to maintain safe navigational depths at the berths. Further, vessel activity at the berths creates minor disturbances of benthic habitats (*e.g*., vessel propeller wakes) during waterfront operations. Therefore, impacts of the proposed project are not likely to have adverse effects on marine mammal foraging habitat in the proposed project area.

All marine mammal species using habitat near the proposed project area are primarily transiting the area; no known foraging or haulout areas are located within 1.5 miles of the proposed project area. The most likely impacts on marine mammal habitat for the project are from underwater noise, bedrock removal, turbidity, and potential effects on the food supply. However, it is not expected that any of these impacts would be significant.

Estimated Take

This section provides an estimate of the number of incidental takes proposed for authorization through this IHA, which will inform both NMFS' consideration of "small numbers" and the negligible impact determination.

Harassment is the only type of take expected to result from these activities. Except with respect to certain activities not pertinent here, section 3(18) of the MMPA defines "harassment" as any act of pursuit, torment, or annoyance, which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).

Authorized takes would primarily be by Level B harassment, as noise generated from in-water pile driving (vibratory and impact), drilling, and blasting has the potential to result in disruption of behavioral patterns for individual marine mammals. The use of the explosive source (*i.e.*, blasting) for a very short period each day has the potential to result in TTS. The primary relevant mitigation measure is avoiding blasting when any marine mammal is observed in the PTS zones. While this measure should avoid all take by Level A harassment, NMFS is authorizing takes by Level A harassment to account for the possibility that marine mammals escape observation in the PTS zone. Additionally, the distances to thresholds for slight lung injury for harbor porpoises (5 m) and phocids (9 m) are small enough that the mitigation and monitoring measures are expected to minimize the potential for such taking to the extent practicable. Therefore the potential for non-auditory physical injury is considered discountable, and all takes by Level A harassment are expected to occur due to PTS.

As described previously, no mortality is anticipated or proposed to be authorized for these activities. The method by which take is estimated is described below.

Generally speaking, NMFS estimates take by considering: (1) Acoustic thresholds above which NMFS believes marine mammals will be behaviorally harassed or incur some degree of permanent hearing impairment; (2) the area or volume of water that will be ensonified above these levels in a day; (3) the density or occurrence of marine mammals within these ensonified areas; and, (4) and the number of days of activities. NMFS notes that while these basic factors can contribute to a basic calculation to provide an initial prediction of takes, additional information that can qualitatively inform take estimates is also sometimes available (*e.g.*, previous monitoring results or average group size). Below, the factors considered here are described in more detail and present the proposed take estimate.

Acoustic Thresholds

NMFS recommends the use of acoustic thresholds that identify the received level of underwater sound above which exposed marine mammals would be reasonably expected to be behaviorally harassed (equated to Level B harassment) or to incur PTS of some degree (equated to Level A harassment). Thresholds have also been developed to identify the pressure levels above which animals may incur different types of tissue damage from exposure to pressure waves from explosive detonations.

Level B Harassment for non-explosive sources – Though significantly driven by received level, the onset of behavioral disturbance from anthropogenic noise exposure is also informed to varying degrees by other factors related to the source (*e.g.*, frequency, predictability, duty cycle), the environment (*e.g.*, bathymetry), and the receiving animals (hearing, motivation, experience, demography, behavioral context) and can be difficult to predict (Southall *et al.,* 2007, Ellison *et al.*, 2012). Based on what the available science indicates and the practical need to use a threshold based on a factor that is both predictable and measurable for most activities, NMFS uses a generalized acoustic threshold based on received level to estimate the onset of behavioral harassment. NMFS predicts that marine mammals are likely to be behaviorally harassed in a manner NMFS considers Level B harassment when exposed to underwater anthropogenic noise above received levels of 120 dB re 1 μPa (rms) for continuous (*e.g.,* vibratory pile-driving, drilling) and above 160 dB re 1 μPa (rms) for impulsive and/or intermittent (*e.g.*, impact pile driving) sources.

Level A harassment for non-explosive sources – NMFS' Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0) (Technical Guidance, 2018) identifies dual criteria to assess auditory injury (Level A harassment) to five different marine mammal groups (based on hearing sensitivity) as a result of exposure to noise from two different types of sources (impulsive or non-impulsive). As mentioned previously, the Navy's Portsmouth Naval Shipyard modification and expansion includes the use of impulsive (*i.e.*, impact pile driving) and non-impulsive (*i.e.,* drilling, vibratory pile driving) sources.

These thresholds are provided in Table 4. The references, analysis, and methodology used in the development of the thresholds are described in NMFS' 2018 Technical Guidance, which may be accessed at *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance*.

Table 4. Thresholds identifying the onset of Permanent Threshold Shift.

	PTS Onset Acoustic Thresholds* (Received Level)	
Hearing Group	Impulsive	Non-impulsive
High-Frequency (HF) Cetaceans	*Cell 5* $L_{pk,flat}$: 202 dB $L_{E,HF,24h}$: 155 dB	*Cell 6* $L_{E,HF,24h}$: 173 dB
Phocid Pinnipeds (PW) (Underwater)	*Cell 7* $L_{pk,flat}$: 218 dB $L_{E,PW,24h}$: 185 dB	*Cell 8* $L_{E,PW,24h}$: 201 dB

* Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered.

Note: Peak sound pressure (L_{pk}) has a reference value of 1 μPa, and cumulative sound exposure level (L_E) has a reference value of 1μPa²s. In this Table, thresholds are abbreviated to reflect American National Standards Institute standards (ANSI 2013). However, peak sound pressure is defined by ANSI as incorporating frequency weighting, which is not the intent for this Technical Guidance. Hence, the subscript "flat" is being included to indicate peak sound pressure should be flat weighted or unweighted within the generalized hearing range. The subscript associated with cumulative sound exposure level thresholds indicates the designated marine mammal auditory weighting function (HF cetaceans and PW pinnipeds) and that the recommended accumulation period is 24 hours. The cumulative sound exposure level thresholds could be exceeded in a multitude of ways (*i.e.*, varying exposure levels and durations, duty cycle). When possible, it is valuable for action proponents to indicate the conditions under which these acoustic thresholds will be exceeded.

Explosive sources – Based on the best available science, NMFS uses the acoustic and pressure thresholds indicated in Table 5 to predict the onset of behavioral harassment, PTS, non-auditory impacts, and mortality. Because of the nature of blasting, there is no established Level B behavioral harassment threshold associated with the activity, but TTS, which is a form of Level B harassment take, may occur. The behavioral threshold used in analyses for multiple explosive events is determined relative to (5 dB less than) the TTS onset threshold (DoN 2017). The references, analysis, and methodology used in the development of the thresholds are described in NMFS 2018 Technical Guidance, which may be accessed at: *http://www.nmfs.noaa.gov/pr/acoustics/guidelines.htm*.

Table 5. Explosive acoustic and pressure thresholds for marine mammals.

Group	Level B harassment		Level A harassment	Non-auditory		Mortality
	Behavioral (multiple detonations)	TTS	PTS	Gastro-intestinal tract	Lung	
High-Frequency (HF) Cetaceans	135 dB SEL	140 dB SEL or 196 dB SPL_{pk}	155 dB SEL or 202 dB SPL_{pk}	237 dB SPL_{pk}	$39.1M^{1/3} (1+[D/10.081])^{1/2}$ Pa-sec where: M = mass of the animals in kg	$91.4M^{1/3} (1+[D/10.081])^{1/2}$ Pa-sec where: M = mass of the animals in kg

Group	Level B harassment		Level A harassment	Non-auditory		Mortality
	Behavioral (multiple detonations)	TTS	PTS	Gastro-intestinal tract	Lung	
Phocid Pinnipeds (PW) (Underwater)	165 dB SEL	170 dB SEL or 212 dB SPL_{pk}	185 dB SEL or 218 dB SPL_{pk}		D = depth of animal in m	D = depth of animal in m

Ensonified Area

The operational and environmental parameters of the activity that will feed into identifying the area ensonified above the acoustic thresholds are described below.

Source Levels

The project includes impact pile driving, vibratory pile driving and pile removal, drilling, and blasting. Source levels of pile driving activities are based on reviews of measurements of the same or similar types and dimensions of piles available in the literature. Based on this review, the sources levels in Table 6 are assumed for the pile driving and drilling underwater noise produced by construction activities.

Table 6. Summary of in-water pile driving source levels (at 10 m from source).

Pile Type	Installation/Extraction Method	Pile Diameter (inch)	SPL_{pk}, dB re 1 μPa	SPL_{rms}, dB re 1 μPa	SEL, dB re 1 μPa^2-s
Z-shaped steel sheet[1,3]	Vibratory	28	NA	167	167
	Impact	28	211	196	181
Flat-webbed steel sheet[1,3]	Vibratory	18	NA	163	163
	Impact	18	205	190	180
Steel pipe[2]	Vibratory	30	NA	167	167
Blast holes[4]	Drilling	4.5	NA	166.2	166.2

Key: dB=decibels; NA = Not applicable; dB re 1 μPa = dB referenced to a pressure of 1 micropascal, measures underwater SPL. dB re 1 μPa2-s = dB referenced to a pressure of 1 micropascal squared per second, measures underwater SEL

[1] = A proxy value for 28-inch sheet piles could not be found for impact and vibratory driving so the proxy for a 30-inch steel pipe pile has been used. A proxy value for 18-inch flat-webbed sheet piles could not be found for impact and vibratory driving so the proxy for a 24-inch Z-shaped sheet pile has been used (NAVFAC MIDLANT 2019a)

Sources: Navy 2015[2]; CALTRANS 2015[3]; Denes *et al*, 2016

The proxy source level for drilling of blast-charge holes is derived from Denes *et al*. (2016), which reports sound pressure levels measured during rock socket drilling at Kodiak Ferry Terminal in Alaska. The size of the blast-charge holes considered here (4.5-inch) is much smaller than the size of the drilled holes (24-inch) in Denes *et al.* (2016), making the use of 166.2 dB re 1µPa conservative.

There are no data on sound source levels from explosives used under circumstances identical to the proposed activity (*e.g.,* charge composition and weight, bathymetry, substrate composition, and the dimensions of holes for stemmed charge placement). Therefore, the Navy made approximations by reference to mathematical models that have been empirically validated, under roughly comparable circumstances, to estimate source levels both in terms of absolute peak sound pressure level (SPL in units of dB re 1µPa) and sound exposure level (SEL in units of dB re 1µPa^2-s) (Table 7). The peak source level calculation of a confined blast follows Cole's (1948) equation and a regression curve from the Miami Harbor Deepening Project (Hempen *et al*. 2007), using a distance of 2.4 m and a weight of 120 lbs for a single charge. Based on this approach, the peak source level for the proposed project is estimated to be 257 dB re 1 µPa for a 120 lb charge. Following Urick (1983), the Navy estimated the SEL for 30, 120 pound charges at 1 m by first calculating the instantaneous pressure following the onset of a shock wave, as a relationship between peak pressure and time. Blasting operations would involve detonating 120 pounds up to 30 times in rapid succession, with a split second delay between each detonation. Without specific information regarding the layout of the charges, the modeling assumes a grid of 2.4 m by 2.4 m charges for the majority of the superflood basin, and 1.5 m by 1.8 m for the rows closest to Berth 11. Due to time and spatial separation of each single charge by a distance of 2.4 m, the accumulation of acoustic energy is added sequentially, assuming the transmission loss follows cylindrical spreading within the matrix of charges. Using this approach for multiple confined charges, the modeled source SEL for 30, 120 pound charges at 1 m is estimated to be 227 dB re 1μPa^2-s. Please see the Navy's IHA application for more details regarding these calculations.

Table 7. Blasting source levels.

Explosive charge	SPL_{pk}, (dB re 1 μPa)	SEL (dB re 1 μPa^2-s)
30 x 120 lb charge	257	227

These source levels for pile driving, drilling, and blasting are used to estimate the Level A harassment and Level B harassment zones. For all construction activities, cumulative SEL values are used to calculate distances to the Level A harassment thresholds using the NMFS acoustic guidance (NMFS 2018) because they were larger than the values calculated against the SPLpeak criteria.

The Level B harassment distances for construction activities are calculated using geometric spreading with the source levels provided in Tables 6 and 7.

Ensonified areas (A) are calculated using the following equation.

$A = \pi R^2$ (1)

where R is the harassment distance.

However, the maximum distance from the source is capped due to landmass interception in the surrounding area. For this reason, the maximum area that could be ensonified by noise from construction activities is an estimated 0.418 km^2 (0.16 square miles). Therefore, all harassment zones that are larger than 0.418 km^2 are corrected to this maximum value. The maximum ensonified area for blasting is smaller (0.335 km^2) because, prior to the removal of bedrock, a portion of the west closure wall will be installed, providing an additional boundary between noise produced within the superflood basin and the surrounding environment.

When the original NMFS Technical Guidance (2016) was published, in recognition of the fact that the ensonified area/volume could be more technically challenging to predict because of the duration component in the new thresholds, NMFS developed a User Spreadsheet that includes tools to help predict a simple isopleth that can be used in conjunction with marine mammal density or occurrence to help predict takes. NMFS notes that because of some of the assumptions included in the methods used for these tools, NMFS anticipates that isopleths produced are typically going to be overestimates of some degree, which may result in some degree of overestimate of Level A harassment take. However, these tools offer the best way to predict appropriate isopleths when more sophisticated 3D modeling methods are not available, and NMFS continues to develop ways to quantitatively refine these tools, and will qualitatively address the output where appropriate. For stationary sources such as in-water vibratory and impact pile driving, NMFS User Spreadsheet predicts the closest distance at which, if a marine mammal remained at that distance the entire duration of the activity, it would not incur PTS. The Level A harassment areas are calculated using the same Equation (1), with corrections to reflect the largest possible area of 0.418 km^2 if the calculation value was larger.

The modeled distances to Level A harassment and Level B harassment isopleths for the marine mammal species likely to be affected by the proposed activities are provided in Tables 8 and 9. As discussed above, the only marine mammals that could occur in the vicinity of the project area are harbor porpoise (high-frequency cetacean) and four species of true seals (phocid).

Table 8. Distances and Areas of Harassment Zones for pile driving and drilling.*

Activity	Pile size, type, and rate	Number of days	Level A harassment				Level B harassment	
			HF cetacean		Phocid			
			Dist. (m)	Area (m^2)	Dist. (m)	Area (m^2)	Dist. (m)	Area (m^2)
Impulsive								
Construct west closure wall	18” flat-webbed sheet pile (12 pile/day)	13	1,763	418	792	380	1,000	405
Entrance structure closure walls	28” Z-shaped sheet pile (12 pile/day)	4	2,056	418	923	395	2,512	418
Non-impulsive								
Construct west closure wall	18” flat-webbed sheet pile (13 pile/day)	13	13.7	0.556	5.6	0.098	7,356	418
Install west closure wall template	30” steel pipe pile (3 pile/day)	5	10.1	0.319	4.1	0.053	13,594	418
Remove west closure wall template	30” steel pipe pile (3 pile/day)	5	10.1	0.319	4.1	0.053	13,594	418
Remove temporary dolphins	30” steel pipe pile (8 pile/day)	2	66.1	10.7	27.2	2.0	46,416	418
Entrance structure closure walls	28” Z-shaped sheet pile (12 pile/day)	4	25.4	1.75	10.4	0.338	13,594	418

Bedrock drilling for blast charges	4.5" (1,580 holes)	130	7	0.153	4.3	0.058	12,023	418

* 418 m^2 is the maximum ensonified area in the project area due to landmass interception of sound propagation.

Table 9. Distances and Areas of Harassment Zones for blasting.*

Blasting Events and Charge	Blasting Days	Level A (PTS onset) Harassment		Level B (Behavioral) Harassment		Non-Auditory Injury
		Harbor Porpoise Distance to 155 dB SEL_{cum} Threshold/Area of ZOI	Phocids Distance to 185 dB SEL_{cum} Threshold/Area of ZOI	Harbor Porpoise Distance to 135 dB SEL_{cum} Threshold/Area of ZOI	Phocids Distance to 165 dB SEL_{cum} Threshold/Area of ZOI	Phocid/Harbor Porpoise Distance to 243 dB Peak Pressure Threshold/Area of ZOI
5 – 30 blasts per event, 120-lb charge per blast event, 150 blast events	130 (1-2 events/ day)	1,007 m/ 335 m^2	110 m/ 9.78 m^2	2,131 m/ 335 m^2	577 m/ 276.36 m^2	5 m/ 0.08 m^2

* 335 m^2 is the maximum ensonified area in the project area due to landmass interception of sound propagation

Marine Mammal Occurrence

Marine mammal density estimates for the harbor porpoise, harbor seal, and gray seal are based on marine mammal monitoring observations during 2017 and 2018 (CIANBRO 2018a,b). Density values were calculated from visual sightings of all marine mammals divided by the monitoring days (a total of 154 days) and the total ensonified area in which the sightings occurred in the 2017 and 2018 activities (0.8401 km^2). Details used for calculations are provided in Table 10 and described below.

Table 10. Marine mammal sightings and resulting density in the vicinity of Portsmouth Naval Shipyard project area.

Species	2017 sighting (96 days)	2018 sighting (58 days)	Total sighting	Density (animal/day/km^2)
Harbor porpoise	3	2	5	0.04
Harbor seal	199	122	321	2.48
Gray seal	24	2	26	0.20

Hooded and harp seals are much rarer than the harbor and gray seals in the Piscataqua River, and no density information for these two species is available. To date, marine mammal monitoring for the Berth 11 Waterfront Improvements Construction project has not recorded a sighting of a hooded or harp seal in the project area (Cianbro 2018ab; NAVFAC Mid-Atlantic 2018, 2019b; Navy 2019; Stantec 2020); however, two harp seals were observed outside of Berth 11 pile-driving activities, one on May 12, 2020 and one on May 14, 2020 (Stantec 2020). The Navy requested authorization of take for these two species and NMFS is acting on that request.

Take Calculation and Estimation

The approach by which the information provided above is brought together to produce a quantitative take estimate is described here.

For marine mammals with known density information (*i.e.*, harbor porpoise, harbor seal, and gray seal), estimated harassment take numbers are calculated using the following equation:

Estimated take = animal density × ensonified area × operating days (2)

However, in consideration of the prevalence of seals in the project area and in accordance with the approach utilized in IHAs previously issued to the Navy for expansion and modification of DD1, NMFS has determined that it is appropriate to increase the number of proposed harbor seal and gray seal Level B behavioral harassment takes. Proposed harbor seal Level B behavioral harassment takes have been adjusted upwards by multiplying the average number of harbor seals sighted per day from May through December 2020 (721 sightings divided by 150 days of monitoring, or 5 harbor seals/day) by the number of proposed actual construction days (159), resulting in 795 proposed Level B behavioral harassment takes. Gray seal proposed Level B harassment takes have been increased utilizing the same approach (47 sightings divided by 150 days of monitoring, or 0.31 gray seals/day), resulting in 50 Level B behavioral harassment takes.

NMFS authorized one Level B harassment take per month each of a hooded seal and a harp seal for the Berth 11 Waterfront Improvements Construction project in both 2018 and 2019. The Navy is requesting authorization of one Level B harassment take each of hooded seal and harp seal per month of construction from January through May when these species may occur (Total of 5 Level B harassment takes for each species).

A summary of estimated and proposed takes is presented in Table 11. Non-auditory take estimates were zero for all species and are, therefore, not included in Table 11.

Table 11. Estimated and proposed takes of marine mammals.

Marine Mammals	Underwater Vibratory Pile-driving and Drilling Criteria (*e.g.*, non-impulsive/continuous sounds)			Underwater Impact Pile-driving and Blasting Criteria (*e.g.*, impulsive sounds)					Estimated total takes	Proposed total takes	Percent population (%)
	Level A (PTS onset) Threshold 173 dB Harbor Porpoise	Level A (PTS onset) Threshold 201 dB Seals	Level B (Behavioral) Harassment Threshold 120 dB[2] RMS	Level A (PTS onset) Threshold 155 dB[1] SEL Harbor Porpoise	Level A (PTS onset) 185 dB SEL Seals	Level B (Behavioral) Harassment Threshold 160 dB[2] RMS	Level B (Behavioral) Harassment Threshold 135 dB[1] SELcum Harbor Porpoise	Level B (Behavioral) Harassment Threshold 165 dB[1] SELcum Seals			
Harbor porpoise	0	NA	2	2	NA	0	2	NA	6	6	0.00
Harbor seal	NA	0	164	NA	22	0	NA	83	269	817	3.01
Gray seal	NA	0	13	NA	2	0	NA	6	21	52	0.00
Hooded seal	NA	0	5	NA	0	0	NA	0	5	5	0.00
Harp seal	NA	0	5	NA	0	0	NA	0	5	5	0.00

[1] dB re 1 µPa²-s.
[2] dB re 1µPa RMS.

Proposed Mitigation

In order to issue an IHA under Section 101(a)(5)(D) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to such activity, and other means of effecting the least practicable impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for taking for certain subsistence uses. NMFS regulations require applicants for incidental take authorizations to include information about the availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks and their habitat (50 CFR 216.104(a)(11)).

In evaluating how mitigation may or may not be appropriate to ensure the least practicable adverse impact on species or stocks and their habitat, as well as subsistence uses where applicable, NMFS carefully considers two primary factors:

(1) The manner in which, and the degree to which, the successful implementation of the measure(s) is expected to reduce impacts to marine mammals, marine mammal species or stocks, and their habitat. This considers the nature of the potential adverse impact being mitigated (likelihood, scope, range). It further considers the likelihood that the measure will be effective if implemented (probability of accomplishing the mitigating result if implemented as planned), the likelihood of effective implementation (probability implemented as planned), and;

(2) The practicability of the measures for applicant implementation, which may consider such things as cost, impact on operations, and, in the case of a military readiness

activity, personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity.

In addition to the measures described later in this section, the Navy will employ the following standard mitigation measures:

- The Navy must employ Protected Species Observers (PSOs), establish monitoring locations, and monitor the project area to the maximum extent possible based on the required number of PSOs, required monitoring locations, and environmental conditions;
- Monitoring must take place from 30 minutes prior to initiation of construction activities through 30 minutes post-completion of construction activities;
- The Navy must conduct a briefing between construction supervisors and crews and the marine mammal monitoring team prior to the start of construction, and when new personnel join the work, to explain responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures;
- For in-water and over-water heavy machinery work, if a marine mammal comes within 10 m, operations shall cease and vessels shall reduce speed to the minimum level required to maintain steerage and safe working conditions;
- With the exception of pre-dawn drilling, work may only occur during daylight hours, when visual monitoring of marine mammals can be conducted;
- For those marine mammals for which take has not been requested, pile removal, drilling, and blasting will shut down immediately when the animals are sighted approaching the harassment zones;

- If take reaches the authorized limit for an authorized species, activity for which take is authorized will be stopped as these species approach the Level B harassment zone to avoid additional take;
- Blasting would not begin until at least one sheet pile face of the west closure wall has been installed; and
- A bubble curtain would be installed across the DD1 entrance openings to mitigate underwater noise impacts outside of the basin during pre-dawn drilling of blast-charge holes, and blasting events.

The following measures would apply to the Navy’s mitigation requirements:

Monitoring Harassment Zones – Before the commencement of in-water construction activities (*i.e.*, impact pile driving, vibratory pile driving and pile removal, drilling, and blasting), harassment zones must be established for purposes of monitoring. Monitoring zones enable observers to be aware of and communicate the presence of marine mammals in the project area outside of the shutdown zone (see below) and thus prepare for a potential cease of activity should the animal enter the shutdown zone. All Level B harassment monitoring zones for the proposed activities are equivalent to the maximum ensonified zone, adjusted for landmass interception, or 0.418 km^2 (0.16 square miles). Similarly, harassment monitoring zones must be established for the PTS isopleths associated with each functional hearing group.

Shutdown Zones -- The Navy will implement shutdown zones for all pile driving and extraction, drilling, and blasting activities. The purpose of a shutdown is to prevent some undesirable outcome, such as auditory injury or severe behavioral disturbance of sensitive species, by halting the activity. If a marine mammal is observed entering or within the respective shutdown zone (Table 12) after a construction activity has begun, the PSO will request a temporary cessation of the construction activity. On days when multiple activities are occurring concurrently, the largest shutdown zone between/among the activities will be implemented. The shutdown zone for blasting would be the entire region of influence (ROI), equivalent to the maximum ensonified zone adjusted for landmass interception (0.418 km^2). If shutdown zones are obscured by fog or poor lighting conditions, pile-driving and blasting will not be initiated until the entire shutdown zones are visible.

Although drilling activities may occur during pre-dawn hours in order to maintain the project schedule, the shutdown distance for drilling is small (10 m) and will likely be entirely visible for monitoring despite visibility limitations during this timeframe. As mentioned previously, drilling will not occur between sunset and pre-dawn hours.

Shutdown zones typically vary based on the activity type and marine mammal hearing group. A summary of the shutdown zones is provided in Table 12.

Table 12. Shutdown zones distances for various pile driving activities and marine mammal hearing groups.

Pile type, size & driving method	Shutdown distance (m)	
	HF cetacean	Phocid
Vibratory drive 30-inch steel pipe piles	70	30
Vibratory extraction 30-inch steel pipe piles	70	30
Impact drive 28-inch steel sheet piles	110	50
Vibratory drive 28-inch steel sheet piles	25	10
Impact drive 18-inch sheet piles	110	50
Vibratory drive 18-inch sheet piles	15	10
Drilling 4.5-inch blast charge holes	10	10
Blasting 120 lb. charge	Entire ROI[1]	Entire ROI

[1]Region of influence (ROI) is the maximum ensonified area (0.418 km^2).

Pre-start Clearance Monitoring- Prior to the start of daily in-water construction activity, or whenever a break in pile driving/removal or drilling of 30 minutes or longer occurs, PSOs will observe the shutdown zones for a period of 30 minutes. The shutdown zone will be considered cleared when a marine mammal has not been observed within the zone for that 30-minute period. If a marine mammal is observed within the shutdown zone, no construction activity, including soft-start (see below), can proceed until the animal has voluntarily left the zone or has not been observed for 15 minutes. When a marine mammal for which Level B harassment take is authorized is present in the Level B harassment zone, activities may begin. If the entire Level B harassment zone is not visible at the start of construction, pile driving activities can begin. If work ceases for more than 30 minutes, the pre-activity monitoring of the shutdown zones will commence.

Soft Start- The use of a soft start procedure is believed to provide additional protection to marine mammals by warning marine mammals or providing them with a chance to leave the area prior to the hammer operating at full capacity, and typically involves a requirement to initiate sound from the hammer at reduced energy followed by a waiting period. The Navy will provide an initial set of strikes from the impact hammer at reduced energy, followed by a 30 second waiting period, and then two subsequent sets. NMFS notes that it is difficult to specify the reduction in energy for any given hammer because of variation across drivers and, for impact hammers, the actual number of strikes at reduced energy will vary because operating the hammer at less than full power results in “bouncing” of the hammer as it strikes the pile, resulting in multiple “strikes”. Soft start will be implemented at the start of each day's impact pile driving and at any time following cessation of impact pile driving for a period of 30 minutes or longer.

Based on our evaluation of the required measures, NMFS has preliminarily determined that the prescribed mitigation measures provide the means effecting the least practicable adverse impact on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.

Proposed Monitoring and Reporting

In order to issue an IHA for an activity, Section 101(a)(5)(D) of the MMPA states that NMFS must set forth requirements pertaining to the monitoring and reporting of such taking. The MMPA implementing regulations at 50 CFR 216.104 (a)(13) indicate that requests for authorizations must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present in the proposed action area. Effective reporting is critical both to compliance as well as ensuring that the most value is obtained from the required monitoring.

Monitoring and reporting requirements prescribed by NMFS should contribute to improved understanding of one or more of the following:

- Occurrence of marine mammal species or stocks in the area in which take is anticipated (*e.g.*, presence, abundance, distribution, density);
- Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic), through better understanding of: (1) Action or environment (*e.g.*, source characterization, propagation, ambient noise); (2) affected species (*e.g.*, life history, dive patterns); (3) co-occurrence of marine mammal species

with the action; or (4) biological or behavioral context of exposure (*e.g.*, age, calving or feeding areas);

- Individual marine mammal responses (behavioral or physiological) to acoustic stressors (acute, chronic, or cumulative), other stressors, or cumulative impacts from multiple stressors;
- How anticipated responses to stressors impact either: (1) Long-term fitness and survival of individual marine mammals; or (2) populations, species, or stocks;
- Effects on marine mammal habitat (*e.g.*, marine mammal prey species, acoustic habitat, or other important physical components of marine mammal habitat); and
- Mitigation and monitoring effectiveness.

Proposed Monitoring Measures

The Navy shall employ trained PSOs to conduct marine mammal monitoring for its PNSY modification and expansion project. The purposes of marine mammal monitoring are to implement mitigation measures and learn more about impacts to marine mammals from the Navy's construction activities.

Protected Species Observer Qualifications

NMFS-approved PSOs shall meet the following requirements:

1. Independent observers (*i.e.*, not construction personnel) are required;
2. At least one observer must have prior experience working as an observer;
3. Other observers may substitute education (undergraduate degree in biological science or related field) or training for experience;

4. Where a team of three or more observers are required, one observer should be designated as lead observer or monitoring coordinator. The lead observer must have prior experience working as an observer; and

5. NMFS will require submission and approval of observer curricula vitae.

Marine Mammal Monitoring Protocols

The Navy will monitor all Level A harassment zones and Level B harassment zones before, during, and after pile driving activities. The Marine Mammal Monitoring Plan would include the following procedures:

- At least two (3) PSOs shall be posted to monitor marine mammals during in-water pile driving and pile removal, blasting, and drilling;
- PSOs will be primarily located at the best vantage point(s) in order to properly see the entire shutdown zone(s) and zones associated with behavioral impact thresholds;
- PSOs must record all observations of marine mammals, regardless of distance from the construction activity;
- During all observation periods, PSOs will use high-magnification (25X), as well as standard handheld (7X) binoculars, and the naked eye to search continuously for marine mammals;
- Monitoring distances will be measured with range finders. Distances to animals will be based on the best estimate of the PSO, relative to known distances to objects in the vicinity of the PSO;
- Pile driving, drilling, and blasting will only take place when the shutdown zones are visible and can be adequately monitored. If conditions (*e.g.*, fog) prevent the

visual detection of marine mammals, activities with the potential to result in Level A harassment shall not be initiated. If such conditions arise after the activity has begun, blasting and impact pile driving would be halted but drilling and vibratory pile driving or extraction would be allowed to continue;

Information Collection:

PSOs shall collect the following information during marine mammal monitoring:

- PSO locations during monitoring
- Date and time that monitored activity begins and ends for each day conducted (monitoring period);
- Construction activities occurring during each daily observation period, including how many and what type of piles driven, number of blast holes drilled, and number or blast events;
- Environmental conditions during monitoring periods (at beginning and end of PSO shift and whenever conditions change significantly); including Beaufort sea state and any other relevant weather conditions, including cloud cover, fog, sun glare, and estimated observable distance;
- For each marine mammal sighting:
  - Name of PSO who sighted the animal(s) and PSO location and activity at time of sighting;
  - Time of sighting
  - Species, numbers, and, if possible, sex and age class of marine mammals;

- Description of any observable marine mammal behavior patterns, including bearing and direction of travel and distance from construction activity;
- Location, distance, and bearing from pile driving, drilling, and blasting activities to marine mammals and distance from the marine mammals to the observation point; and
- Animal's closet point of approach and estimated amount of time that the animals remained in the Level B harassment zone; and
- Detailed information about implementation of any mitigation (*e.g.*, shutdowns or delays), a description of specific actions that ensued, and resulting changes in behavior of the animal(s), if any.

Hydroacoustic monitoring

The Navy must conduct hydroacoustic monitoring of in-water construction activities, including the installation of (10) Z-shaped sheet piles for both impact and vibratory pile driving, (4) steel piles for vibratory pile driving, (10) blasting event, and (10) blast-charge hole drilling events.

Reporting Measures

The Navy is required to submit a draft monitoring report (including all PSO data sheets and/or raw sighting data) within 90 days after completion of the construction work or the expiration of the IHA (if issued), whichever comes earlier. If Navy intends to request a renewal of the IHA (if issued) in a subsequent year, a monitoring report should be submitted no less than 60 days before the expiration of the current IHA (if issued). This report would detail the monitoring protocol, summarize the data recorded during monitoring, and estimate the number of marine mammals that may have been harassed. The acoustic monitoring report must contain the informational elements described in the hydroacoustic monitoring plan. NMFS would have an opportunity to provide comments on the report, and if NMFS has comments, The Navy would address the comments and submit a final report to NMFS within 30 days.

In addition, NMFS would require the Navy to notify NMFS' Office of Protected Resources and NMFS' Greater Atlantic Stranding Coordinator within 48 hours of sighting an injured or dead marine mammal in the construction site. The Navy shall provide NMFS and the Stranding Network with the species or description of the animal(s), the condition of the animal(s) (including carcass condition, if the animal is dead), location, time of first discovery, observed behaviors (if alive), and photo or video (if available).

In the event that the Navy finds an injured or dead marine mammal that is not in the construction area, the Navy would report the same information as listed above to NMFS as soon as operationally feasible.

Negligible Impact Analysis and Determination

NMFS has defined negligible impact as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival (50 CFR 216.103). A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (*i.e.*, population-level effects). An estimate of the number of takes alone is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be "taken" through harassment, NMFS considers other factors, such as the likely nature of any responses (*e.g.*, intensity, duration), the context of any responses (*e.g.*, critical reproductive time or location, migration), as well as effects on habitat, and the likely effectiveness of the mitigation. NMFS also assesses the number, intensity, and context of estimated takes by evaluating this information relative to population status. Consistent with the 1989 preamble for NMFS's implementing regulations (54 FR 40338; September 29, 1989), the impacts from other past and ongoing anthropogenic activities are incorporated into this analysis via their impacts on the environmental baseline (*e.g.*, as reflected in the regulatory status of the species, population size and growth rate where known, ongoing sources of human-caused mortality, or ambient noise levels).

Pile driving, drilling, and blasting activities associated with the proposed project, as described previously, have the potential to disturb or temporarily displace marine mammals. The specified activities may result in take, in the form of Level A harassment (potential injury; from impact pile driving or blasting) or Level B harassment (potential behavioral disturbance or TTS) from underwater sounds generated from pile driving (impact and vibratory), drilling and blasting. Potential takes could occur if individual marine mammals are present in the ensonified zone when pile driving, drilling, or blasting activities are occurring.

To avoid repetition, this introductory discussion of our analysis applies to all of the species listed in Table 2, given that the anticipated effects of the Navy's PNSY modification and expansion construction project activities on marine mammals are expected to be relatively similar in nature. There is no information about the nature or severity of the impacts, or the size, status, or structure of any species or stock that would lead to a different analysis by species for this activity, or else species-specific factors would be identified and analyzed.

Although some individual harbor porpoises and harbor and gray seals are estimated to experience Level A harassment in the form of PTS if they remain within the impact pile driving Level A harassment zone for an entire day, or are present within the Level A harassment zone during a blasting event, the degree of injury is expected to be mild and is not likely to affect the reproduction or survival of the individual animals. It is expected that, if hearing impairments occurs as a result of impact pile driving or blasting, most likely the affected animal would lose a few dB in its hearing sensitivity, which in most cases is not likely to affect its survival and recruitment. Hearing impairment that might occur for these individual animals would be limited to the dominant frequency of the noise sources, *i.e.*, in the low-frequency region below 2 kHz. Nevertheless, as for all marine mammal species, it is anticipated that, in general, these pinnipeds will avoid areas where sound levels could cause hearing impairment. Therefore it is not likely that an animal would stay in an area with intense noise that could cause severe levels of hearing damage.

Under the majority of the circumstances, anticipated takes are expected to be limited to short-term Level B behavioral harassment or TTS. Marine mammals present in the vicinity of the action area and taken by Level B harassment would most likely show overt brief disturbance (startle reaction) from blasting events and avoidance of the area impacted by elevated noise levels during pile driving (and removal). Given the limited estimated number of predicted incidents of Level A harassment and Level B harassment and the limited, short-term nature of the responses by the individuals, the impacts of the estimated take cannot be reasonably expected to, and are not reasonably likely to, rise to the level that they would adversely affect the species considered here at the population level, through effects on annual rates of recruitment or survival. There are no known important habitats, such as rookeries or haulouts, in the vicinity of the Navy's proposed PNSY DD1 modification and expansion construction project. The project also is not expected to have significant adverse effects on affected marine mammals' habitat, including prey, as analyzed in detail in the **Potential Effects of Specified Activities on Marine Mammals and their Habitat** section.

In summary and as described above, the following factors primarily support our preliminary determination that the impacts resulting from this activity are not expected to adversely affect the species or stock through effects on annual rates of recruitment or survival:

- No mortality is anticipated or authorized;
- Some individual marine mammals might experience a mild level of PTS, but the degree of PTS is not expected to affect their survival;
- Most adverse effects to marine mammals are likely to be temporary behavioral harassment or TTS; and
- No biologically important area is present in or near the proposed construction area.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the proposed monitoring and mitigation measures, NMFS preliminarily finds that the total marine mammal take from the proposed activity will have a negligible impact on all affected marine mammal species or stocks.

Small Numbers

As noted above, only small numbers of incidental take may be authorized under section 101(a)(5)(A) and (D) of the MMPA for specified activities other than military readiness activities. The MMPA does not define small numbers and so, in practice, NMFS compares the number of individuals taken to the most appropriate estimation of abundance of the relevant species or stock in our determination of whether an authorization is limited to small numbers of marine mammals. When the predicted number of individuals to be taken is less than one third of the species or stock abundance, the take is considered to be of small numbers. Additionally, other qualitative factors may be considered in the analysis, such as the temporal or spatial scale of the activities.

NMFS proposes to authorize incidental take of 5 marine mammal stocks. The total amount of taking proposed for authorization is three percent or less for all five of these stocks, (Table 11).

Based on the analysis contained herein of the proposed activity (including the prescribed mitigation and monitoring measures) and the anticipated take of marine mammals, NMFS preliminarily finds that small numbers of marine mammals will be taken relative to the population size of the affected species or stocks.

Unmitigable Adverse Impact Analysis and Determination

There are no relevant subsistence uses of the affected marine mammal stocks or species implicated by this action. Therefore, NMFS has determined that the total taking of affected species or stocks would not have an unmitigable adverse impact on the availability of such species or stocks for taking for subsistence purposes.

Endangered Species Act (ESA)

No incidental take of ESA-listed species is proposed for authorization or expected to result from this activity. Therefore, NMFS has determined that formal consultation under section 7 of the ESA is not required for this action.

Proposed Authorization

As a result of these preliminary determinations, NMFS proposes to issue an IHA to the Navy for the taking of marine mammals incidental to modification and expansion of the Portsmouth Naval Shipyard Dry Dock 1 in Kittery, Maine, effective for one year from the date of issuance, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated. A draft of the proposed IHA can be found at *https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act*.

Request for Public Comments

NMFS requests comment on these analyses, the proposed authorization, and any other aspect of this Notice of Proposed IHA for the proposed issuance of an IHA to the Navy for the taking of marine mammals incidental to modification and expansion of the Portsmouth Naval Shipyard Dry Dock 1 in Kittery, Maine, effective for one year from the date of issuance. NMFS also requests comment on the potential for a renewal of this proposed IHA as described in the paragraph below. Please include with your comments any supporting data or literature citations to help inform NMFS' final decision on the request for MMPA authorization.

On a case-by-case basis, NMFS may issue a one-time, 1-year IHA renewal with an expedited public comment period (15 days) when: (1) Another year of identical or nearly identical activities as described in the Specified Activities section is planned or (2) the activities would not be completed by the time the IHA expires and a second IHA would allow for completion of the activities beyond that described in the *Dates and Duration* section, provided all of the following conditions are met:

- A request for renewal is received no later than 60 days prior to expiration of the current IHA;
- The request for renewal must include the following:

(1) An explanation that the activities to be conducted under the proposed renewal are identical to the activities analyzed under the initial IHA, are a subset of the activities, or include changes so minor (*e.g.*, reduction in pile size) that the changes do not affect the previous analyses, mitigation and monitoring requirements, or take estimates (with the exception of reducing the type or amount of take because only a subset of the initially analyzed activities remain to be completed under the renewal); and

(2) A preliminary monitoring report showing the results of the required impacts of a scale or nature not previously analyzed or authorized;

- Upon review of the request for renewal, the status of the affected species or stocks, and any other pertinent information, NMFS determines that there are no more than minor changes in the activities, the mitigation and monitoring measures will remain the same and appropriate, and the findings in the initial IHA remain valid.

Dated: March 29, 2021.

Donna S. Wieting,

Director, Office of Protected Resources,

National Marine Fisheries Service.

[FR Doc. 2021-06782 Filed: 4/7/2021 8:45 am; Publication Date: 4/8/2021]